# SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIX.—No. 20.
ESTABLISHED 1845.

NEW YORK, NOVEMBER 11, 1893.

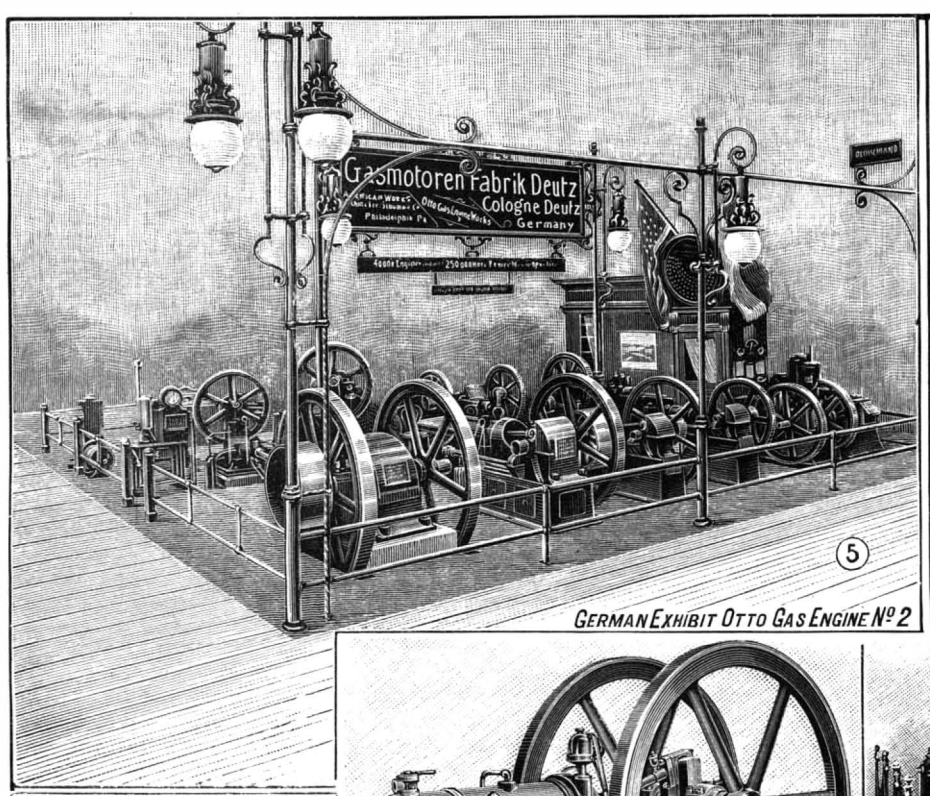
$3.00 A YEAR.
WEEKLY.


## THE OTTO GAS ENGINES AT THE COLUMBIAN EXPOSITION.

The attentive visitor at our World's Fair cannot have failed to notice the large number of gas engines exhibited by almost all of the nations represented there, and involuntarily to draw comparison with the small beginning this industry showed at our Centennial Exhibition in 1876. Similar to the advance made in electric lighting and the telephone, which at the Centennial were exhibited in their infantine state, and which have grown since so as to fill a building for themselves, so the gas engine, with its varieties of adaptations for gasoline and petroleum, has been developed and matured, and has formed so large a group that if all the various engines had been collected in one building, it would have required one of quite large dimensions.

Germany was specially prolific in its productions of this kind, as well as England, while France, Russia, and Spain were also represented, without mentioning the exhibits of numerous American gas and gasoline engine companies. In this line of industry the Otto gas, gasoline, and petroleum engines have always occupied a very prominent position, and it was they who marked the birth of this new motor, for practical uses, at the Centennial Exhibition, over seventeen years ago, and which have ever since been prominently before the public. The Otto has had a most remarkable growth, and has been introduced in many parts of the civilized world, and in many countries special works have been erected solely for the manufacture of gas engines under the patents of the late Dr. Nicolaus A. Otto, and under such other patents as have been subsequently taken out by his successors, and which are the common property of all the various companies interested in this particular manufacture. On this page we illustrate several of the more important of these exhibits.

The German Gas Engine Works made an especially



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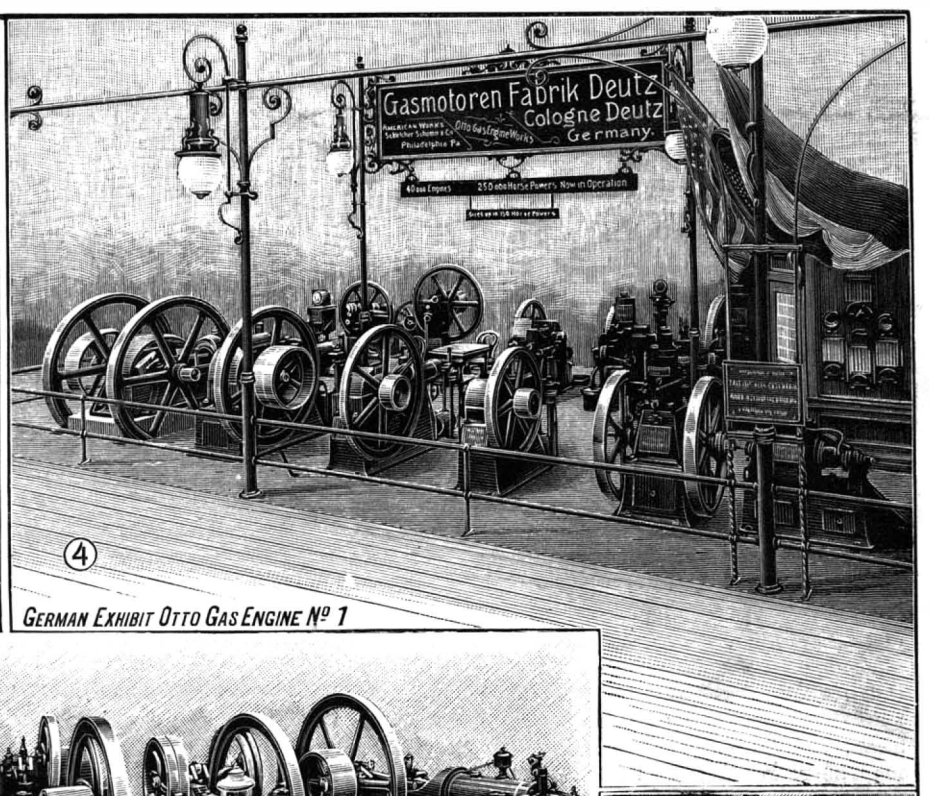

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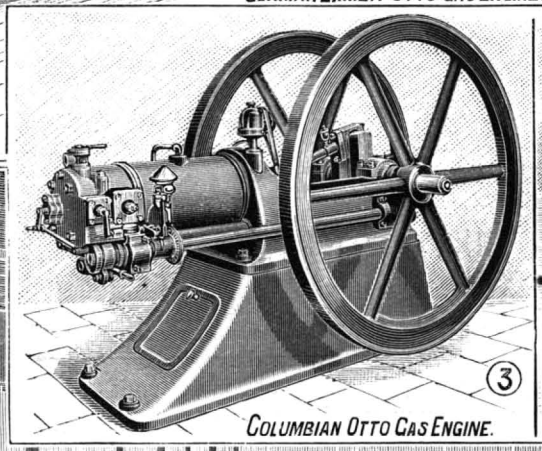
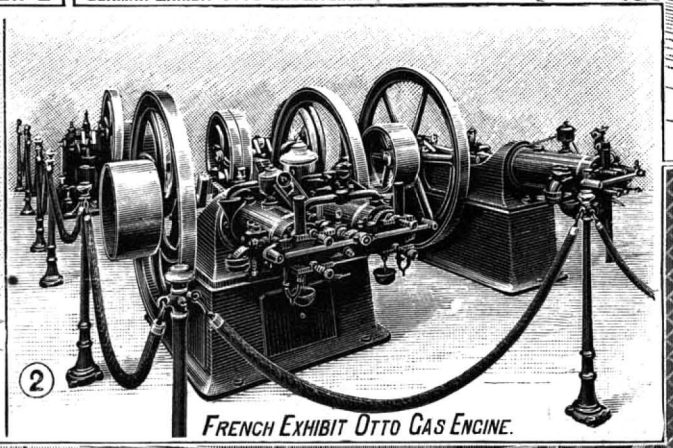
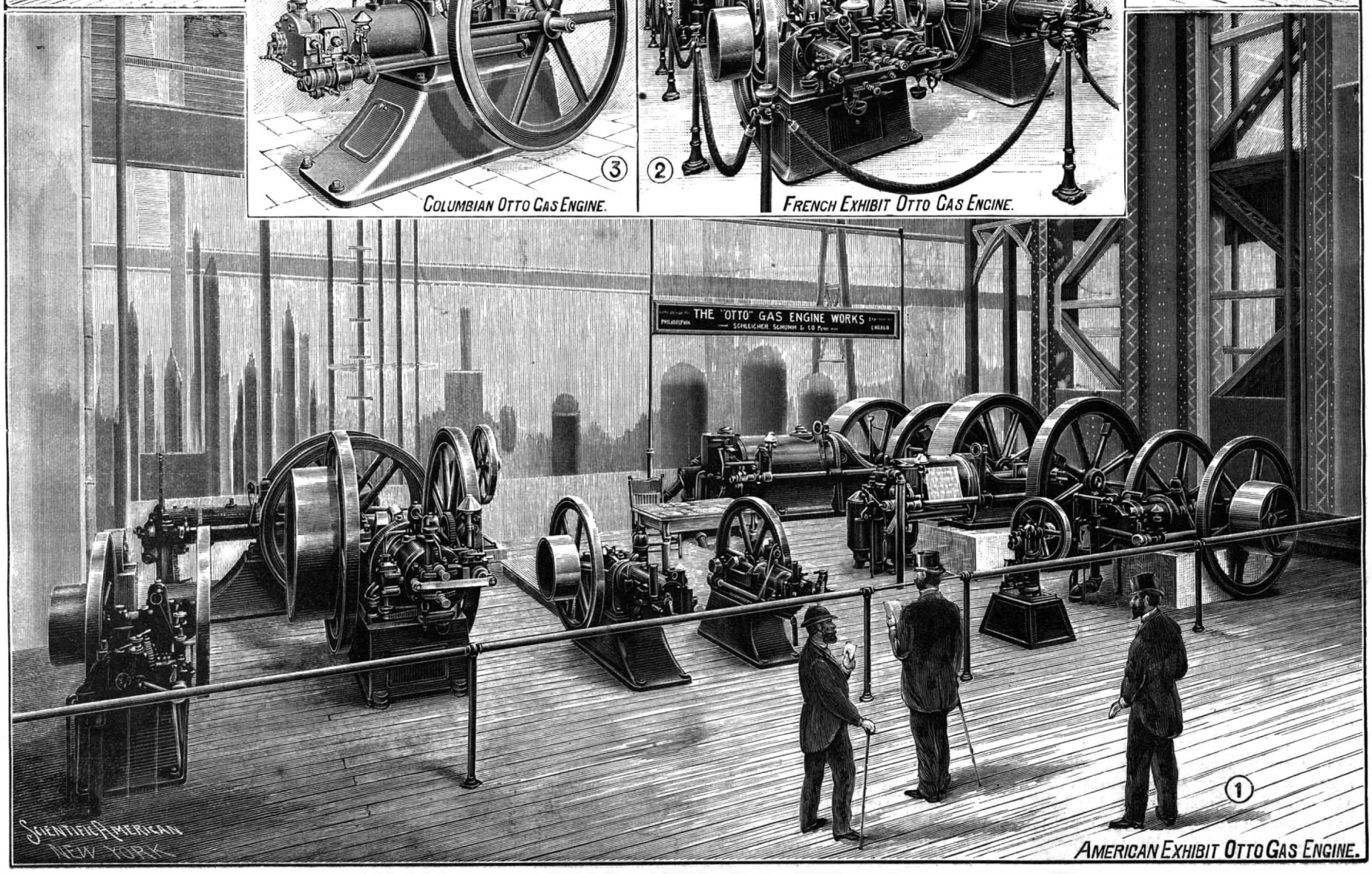


COLUMBIAN OTTO GAS ENGINE.



FRENCH EXHIBIT OTTO GAS ENGINE.



AMERICAN EXHIBIT OTTO GAS ENGINE.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE OTTO GAS ENGINE CO.

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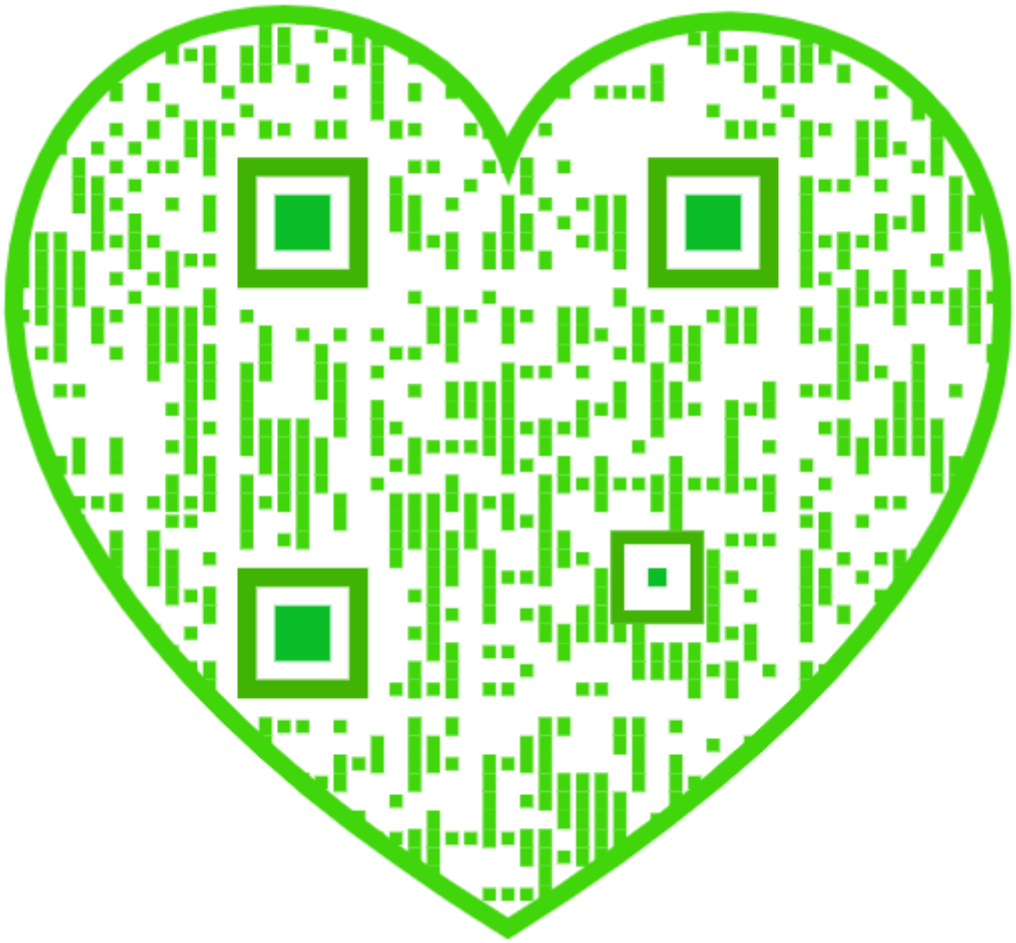

creditable exhibit of some ten engines, which illustrated the various methods of ignition, such as slide valve, electric and magnetic ignition, which were gradually developed in their works and which illustraied the modern practices in gas engine building. Some engines were shown with dynamos combined and attached to the engine shaft; others were petroleum engines, but all showing the extremely high finish and care of details which almost universally characterized all the German exhibits at the Fair. The German works are located at Deutz, near Cologne, and employ over 1,000 hands, having a capacity of 1,500 engines a year and the cash capital employed is $1,500,000. The Paris Otto Gas Engine Works also make a fine exhibit, though of much smaller dimensions and exhibiting but a few types of engines. Their offices are located at 15 Avenue de l'Opera and their works employ over 200 hands. As may have been expected, the American manufacturers of the Otto gas engine, at Philadelphia, have attracted great attention by the large varieties of engines shown, and specially by the extremely low gas consumption of 16·5 cubic feet per actual horse power per hour, which test was submitted to the judges and offered for verification by practical tests.

The American exhibit included an engine of 120 horse power, as well as one of 60 horse power. The interesting feature of these large engines consisted in self-starting apparatus, which materially differed from any similar devices heretofore made. The exhibit also contained engines especially designed for running idle at an extremely low gas consumption or expense for friction, and furthermore possessed many interesting varieties of designs, including vertical engines, twin cylinder as well as the ordinary horizontal type. Most sizes are available for gaseous fuel (coal gas, natural gas or producer gas) or for liquid fuel (gasoline and petroleum). This liquid fuel has widened the market of this kind of motor very largely and made the engines available for country uses for farming as well as manufacturing. The Philadelphia house also exhibited a portable engine for farm uses in the agricultural annex. The cost of running such power is very attractive to the farmers, being as low as one cent per horse power per hour at the usual retail cost of gasoline.

The Columbian Style Otto engine was brought out specially for the Columbian year, and intended to embody the best devices known at the present time, and is the special pride of the Philadelphia firm. Its important feature consists in having all valves or all movable parts located in separate casings which drop out of pockets left in the main casting of the engine cylinder. In this manner the wear and tear affect pieces that can be taken out, and which are independent of the main casting of the engine; and thus the engine may be subjected practically to an almost indefinite amount of use, as the movable parts may be renewed from time to time as they become worn.

The products of the Otto Gas Engine Works, of Philadelphia, can be said to be the practical results of over twenty years' experience in the gas engine business, acquired not only by the practical work carried on at their Philadelphia shops, but through the reports sent to them by their correspondents in other countries with whom they have a common interest. Their shops at Philadelphia have a capacity of 800 engines a year, and their representatives are in every market in the United States, besides they own branch houses and offices in Chicago, Omaha, Indianapolis, Pittsburg, Boston and New York.

### Cooking by Gas.

In the course of a very successful series of lectures on cooking by gas which Madam Alting-Mees has lately delivered in Brussels, at the invitation of the Belgian Association of Gas Managers, she took the opportunity of impressing upon her audience the great importance of a knowledge of cookery to all who are, or are likely to be, at the head of a household. When discoursing, whether in French or in English, on cooking by gas, Madam Alting-Mees shows that she not only understands her subject thoroughly, but also how to place it before her hearers in such an attractive way as to make them understand it. The attainment of this end is something to have achieved. But this lady has higher aims than merely producing a number of excellent cooks with the aid of gas stoves and gaseous fuel. She would have women and girls—and more especially the latter—turn their attention *con amore* to the culinary art as a very powerful factor in the promotion of domestic comfort and happiness. If they have been reluctant to do so hitherto, because the conditions under which the operations in this department of household management have been performed have not been altogether agreeable, such a feeling should not exist in these days, when, as Madame Alting-Mees and others have demonstrated over and over again, both the appliances used and the fuel employed in them conduce to, rather than militate against, the cleanliness which, as admitted by everybody, it is so highly essential to secure in preparing food for the table.


# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

**No. 361 BROADWAY, NEW YORK.**

O. D. MUNN. A. E. BEACH.

**TERMS FOR THE SCIENTIFIC AMERICAN.**

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

**The Scientific American Supplement**

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MUNN & CO., Publishers,
361 Broadway, New York.

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NEW YORK, SATURDAY, NOVEMBER 11, 1893.

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### AMATEUR NAVAL OPERATIONS.

A curious state of things exists at Rio de Janeiro, Republic of Brazil. The admiral commanding the naval vessels in the harbor, not satisfied with the proceedings of the existing government, revolted and for some time past has been engaged in bombarding different parts of the city, the chief result up to the present time being the killing of innocent citizens and the burning of private property. The admiral's revolt appears to have been so unexpected that he had time to make a clean sweep of all the vessels in the harbor that were likely to be of any use to the government in annoying him; so that the only means of attacking the admiral was by shooting at his ships from the land forts whenever the vessels came near enough. Not much damage to the navy has as yet been done, as the boats are careful to keep out of harm's way and the gunners in the forts appear to be poor marksmen.

In the meantime the government has cabled to this country and to Europe, ordering the purchase and immediate preparation for sea and for war of vessels likely to be of use in opposing the ships of the rebels. Among the latter are several notable ironclads. The vessels purchased in New York comprise some new, stanch, and fast merchant steamers, in which guns are being mounted, and they will soon sail for Brazil. This new navy also comprises several small and very fast private steam yachts, which are to be used as torpedo boats. Ericsson's boat, the Destroyer, which fires a submarine torpedo, is also in the category. Whether any of these can be made available in conquering the rebel navy is a question. Much depends upon the skill and daring of the crews who man the boats. Experience shows that one good torpedo, if it strikes an ironclad, will sink her. It is said that at present there are hundreds of men out of employment here who would be glad to go to Brazil and do some fighting for the government.

An interesting question is what could Yankee ingenuity probably do from the shore, at Rio, to drive off the enemy, under the circumstances in which the Brazilians now find themselves? We will leave to our ingenious readers the study and suggestion of new devices, first reminding them of certain interesting incidents in this line, which once took place in this harbor. We quote from the SCIENTIFIC AMERICAN of May 16, 1885:

"For some days past the British war steamer Garnet has been lying at anchor in the harbor of New York, her officers and crew the recipients of the usual hospitalities accorded to visitors from friendly nations. In view of the various dynamite outrages that of late have been perpetrated, especially in London, it was rumored the Garnet was especially guarded with a view to prevent any secret attempt at injury to her hull. This rumor led Captain Paul Boyton, the famous swimmer, to undertake a practical test of one of his theories. It has long been maintained by him that by his swimming suit he can approach any vessel, however well guarded, and can fasten a torpedo to her bottom, and get away to a safe distance from which to view her destruction. He believes it hardly possible to detect him, and possible only after the work has been done. Torpedo warfare, conducted by the regular torpedo boat, is confessedly hazardous and costly. Several lives are exposed and several thousand dollars risked at each attempt. But Boyton's method of swimming out to a vessel, sinking underneath her, rising at the end that cuts the tide, and fastening his deadly and timed machine to her anchor chain, exposes only one life, risks only a few dollars of value, and accomplishes, with fifty times the certainty of any other scheme, a destruction sure, terrible, and complete. On the night of May 5 last the gallant captain, who, by the way, is an Englishman, undertook to show to some of his friends the correctness of his assertions. According to the *Tribune*, he provided himself with the shell of a torpedo of the usual pattern, about two feet long, with clockwork at one end so arranged as to set it off five minutes after the machinery was started. It was loaded with little cracked stones instead of explosive material. It contained air chambers of sufficient size to float it easily, and was supplied with about ten yards of rope with which to tow it and to tie it up against the ship. The rope was slipped around the swimmer's foot, and he started off from the Staten Island shore toward the Garnet, half a mile or so distant.

"As the swimmer approached the war vessel, he expelled the air from his suit and sank deep into the water, drifting with the tide under the ship, and reappearing near her anchor chains at the starboard bow. He reconnoitered gingerly about this perilous spot. If he was detected, the probability that they would shoot first and inquire afterward was fully impressed on his mind. He had no disposition to submit himself to this risk. He could hear the men in the bows whispering faintly, and the heavy plod, plod, of the watches on the decks. Finally he touched the anchor chain. He came nearer and nearer, and grasped it with his hand. Drawing his foot up, he undid the knot which had held the torpedo in tow, and carefully threw the rope over the anchor chain. He drew its end toward him, and tied it securely in three knots. Then

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he swam down to the torpedo, and placed it against the vessel on the starboard side just amidships. He shoved himself off. In five minutes more, had the torpedo been charged, the Garnet would have been blown up.

"This recent midnight prank of Boyton's recalls the attempt of Sergt Lee, of the American army, to blow up Lord Howe's flagship Eagle in the same waters in 1776. It is curious to note how closely that earliest attempt to use a submerged torpedo in actual warfare was imitated by Boyton, save that he was clad in rubber instead of oak, and loaded his torpedo with broken stone and an advertising card instead of gunpowder and means for exploding it. Both adventurers meant business, but not precisely in the same sense.

"Sergt. Lee operated a torpedo boat invented by David Bushnell, afterward captain in the patriotic army. It had been tried with some success experimentally, and gave promise of being useful in serious warfare. The first opportunity for such use was offered when the British fleet of 37 men-of-war and 400 transports took possession of New York harbor. The fleet lay in the lower bay, just inside Sandy Hook.

"From the description given of the Bushnell boat, it would seem to be more like a barrel than a boat. It was of oak, iron-banded, and only large enough for one person. When floating upright, the navigator's head was a little above the level of the water. By means of two force pumps, worked by the occupant's feet, the vessel could be made to sink or rise in the water, by forcing water out or in, and so changing its specific gravity. Its progress horizontally was governed by two revolving paddles in front, turned by a crank inside. The torpedo was fastened to the back of the boat by a screw, the release of which set in motion a clock connected with a gun lock and flint. After the predetermined interval of time had elapsed, the clock would strike and ignite the powder.

"The torpedo carried by Lee against the Eagle was charged with 150 pounds of powder (some say 130 pounds), and the clock was set to explode the charge in thirty minutes after the torpedo was placed. Lee was towed to the neighborhood of the fleet by a party in whale boats, and then proceeded to attack the fleet alone. He succeeded in reaching the Eagle, a 64-gun ship, undetected, and spent a long time in a vain attempt to fasten the torpedo to her bottom with hooks and screws; a band of iron at the edge of the copper sheathing proving an especially serious obstacle. As daylight approached, he was compelled to leave the fleet and return to the city. Off Governor's Island he was intercepted by a British barge, when, to avoid capture, he exploded his torpedo, escaping from his pursuers during the panic which the explosion excited.

"A Bushnell torpedo boat was used more successfully a year later in the harbor of New London, Conn., where a prize schooner, in charge of the man-of-war Cerberus, was blown up and destroyed.

"As an act of discourtesy to a friendly visitor, Boyton's prank has little to commend it. As a practical demonstration of a new risk to war ships at anchor, even in a friendly port, it has a different and wider bearing. Bushnell's idea of matching one man against a ship may, after all, be the true one. It is obvious that one torpedo placer, able to swim Boyton-fashion on or under water, is much less liable to detection than a torpedo boat, and much less easily guarded against; for he could approach unseen and pass under the booms and networks which suffice to explode or ward off torpedoes of the usual sort. If Sergt. Lee's torpedo had been provided with a strong magnet, the strip of iron which thwarted him would have insured the success of his undertaking, and the use of torpedoes in naval warfare might have been hastened half a century, materially changing the current of more recent naval and political history."

### The Hot Blast Furnace Three Thousand Years Old.

Is there anything new under the sun? asks the *Railway Review*, and then adds Solomon was right. The more the past is explored the more evident this becomes. A prehistoric blast furnace is the latest discovery! Professor Flinders Petrie, in 1890, convinced himself that in a remarkable mound called Tel-el-Hesy, in South Palestine, would be found the remains of what was one of the strangest places in the country down to the invasions of Sennecherib and Nebuchadnezzar. The explorations, said Mr. Bliss at the Palestine exploration fund meeting recently, have fully verified this forecast. Amid all the evidence discovered by Mr. Bliss of the civilization of that remote age—wine presses, treacle presses, alkali burnings and innumerable others—by far the most curious is the disclosure of an iron blast furnace, arranged to give strong evidence of being intended to heat, in its descent, a blast of outside air forced through passages before entering the chamber at the level where tuyeres are usually found. "If this theory be correct," says Mr. Bliss, "we find, 1,400 years before Christ, the use of the hot air blast instead of cold air, which is called a modern improvement in iron manufacture due to Neilson, and patented in 1828."

The World's Columbian Exposition passed out of existence and became a thing of the past with dignified and impressive silence on Monday, October 30. A programme had been prepared for the day which was to be one of the most memorable events of the Exposition, but the tragic death of Mayor Carter Harrison, of Chicago, at the hands of an assassin put a sudden end to all outbursts of enthusiasm.

For several days preceding the closing day the weather had been unusually chilly, and as there were no means at hand of heating the buildings, the attendance was not as large as had been anticipated; nevertheless, on the closing day there were over 200,000 paid admissions. The formal exercises by which the Exposition was declared closed were held in Festival Hall and were of the simplest nature. Following these a national salute was fired on the lake front, and simultaneous with this every flag in the Exposition grounds, save one, dropped from its staff. This one flag that was reserved was the great banner flying from a staff at the east front of the Administration building. This was hauled down with much ceremony, while a band in a stand near by played the "Star-Spangled Banner" and "America."

In the evening the illumination was one of the grandest yet held. Every electric light that could be pressed into service shed forth its rays, and the crowds of visitors took a last parting look at the dreamland effect. At eleven o'clock the last light, except those on the police circuits, was darkened. In the meantime, exciting scenes were being enacted on Midway Plaisance. The rabble let itself loose and marched up and down the broad street blowing horns, tearing away awnings, and becoming more boisterous every minute. Finally, an attack was made on the Chinese theater with a view to looting it, but the Columbian guards called a halt, and the crowd was dispersed.

During the day, Monday, while the crowds were seeing the Exposition for the last time, the transportation department was gathering on the tracks outside the terminal station railway material by the train load, preparatory to begin laying tracks for removing exhibits the instant the crowd vanished. Hundreds of men gathered at the lower corner of the grounds seeking employment, and Tuesday morning the busiest of scenes were enacted as the tracks were ready to be laid across the plaza on each side of the Administration building and elsewhere throughout the grounds. The warehouses containing the packing boxes had been besieged for days previous to the closing, and trains of flat cars were loaded with empty cases ready to be hauled to their destination. Not a moment seems to have been lost.

The attendance at the Exposition falls short of what had been anticipated. The management had counted upon 30,000,000 paid admissions, while the actual attendance was 22,225,000 full admissions and 1,650,000 children's admissions. The free admissions were over 6,000,000. It will be some time yet before the actual receipts can be stated, but they will exceed $33,000,000, so that the Exposition will be able to pay all expenses and probably have between $2,000,000 and $3,000,000 to distribute to stockholders.

The wrought iron gates that stood in front of the German section in the Manufactures and Liberal Arts building were highly commended for the quality of workmanship in them; but this was not the only exhibit of this nature that received high commendation, for back in the northwestern corner of the building, in an unfortunately secluded location, was a magnificent gate of American manufacture. This gate was in the exhibit of the Winslow Brothers Company, and was probably the largest piece of wrought iron work ever produced in this country, as it stood thirty-three feet high and was twenty-three feet wide. Every part of the gate was wrought by hand, the only tools the workman used being a forge and anvil, a hammer and a pair of tongs. It was constructed of Swedish and Norwegian iron, together with open hearth low grade American steel, which was used in the more decorative and ornamental features. Each bud and flower in the delicate ornamentation was shaped from a solid piece of metal, while the leaves of each rose were cut and formed by hand, no rivets being used. The masks and faces were hammered out of solid plates of steel five-sixteenths of an inch in thickness. The workman used no form or mould of any kind, but depended upon his skill and his eye to produce the fine results.

Musicians had a feast in studying the collection of keyed and stringed instruments in the display of historical instruments exhibited by M. Steinert. This exhibit contained a fine collection of clavichords, spinets, virginals, harpsichords, hammerclavieres, and piano fortes. One clavichord, which dates back to 1500 and something, was four and one-half octaves, and was so constructed that two different tones were produced upon each set of strings. Another clavichord, with the same size of keyboard, was incased in a case of rococo style, in white enamel and gold. It is only a century older than the previous one mentioned and of the same general type. The most interesting and valuable spinet exhibited was a double one, each board of four octaves, made and painted by the famous Hans Ruckers, of Antwerp, before the year 1600. The small spinet at the left in this instrument sets into the case of the spinet proper, and was tuned one octave higher than the other. In performing upon both instruments at the same time, the smaller one could be removed from its case and set upon a table. The painting on the inner side of the lid represents a contest before the gods between Apollo and Marsyas, the former playing a viol and the latter a pipe. The rest of the case is elaborately painted. With the exception of a similar spinet at Nuremburg, this is probably the only other double one in existence. Another spinet exhibited is similar to the favorite one used by Handel.

A harpsichord that was very complete was one of two keyboards of five octaves, made in London in 1769 by Jacobus Kirkman. This had seven registers, two of eight and one of four-foot tone, one harp, one lute, and one machine stop. Another instrument, somewhat similar to this, with a very rich inlaid case, was formerly owned by Napoleon Bonaparte. The oldest harpsichord exhibited had a single keyboard of four and one-third octaves, and was made in Pisa in 1626. The case to this was elaborately painted. It is one of the oldest instruments in existence. An upright hammerclaviere which attracted much attention was one of four and one-half octaves with two knee pedals, which had a case much like an old-fashioned secretary in shape. The strings ran in a horizontal direction, just opposite to the usual upright piano. This instrument is tuned to the right. The most peculiar-shaped instrument shown was a piano forte of four octaves, made in the form of a lady's sewing table.

Three pianos of early American manufacture were exhibited, the oldest one having been made in New York in 1815 by John Geib. This instrument is inlaid with brass and rests upon a frame of claw feet, which are finely carved and gilded. Among the concert grand pianos exhibited was one that was the property of Haydn. Another similar instrument is the exact counterpart of the one used by Mozart. A concert grand piano that was used by Beethoven attracted more attention than any other instrument in the exhibit. This was not very unlike the others, although it was six and one-half octaves in size. A piano violin was one of the most peculiar instruments in the collection. This was upright and the strings were made of wire, as in an ordinary piano forte, but of greater relative thickness and with one to each note. These wires run in a vertical direction and had attached to each a small bundle of bristles projecting in front about an inch. A metallic roller, with resin on it, is made to turn by means of treadles, and when the keys are pressed down a tangent, holding a piece of whalebone, presses the bristles toward the roller, and motion is communicated through them to the strings and musical vibration is excited. The effect of this on the ear is not unlike that of a string orchestra.

The Columbian Museum, which has been talked about for some weeks as an institution that should be organized to retain some of the exhibits at the Exposition, has now become a tangible and assured success by the donation of $1,000,000 toward a fund to support it by Mr. Marshall Field, of Chicago, and $100,000 by George M. Pullman. There are many valuable exhibits in nearly all of the departments that were either purchased outright by the Exposition or solicited in such a manner that the Exposition has the disposal of them. This is especially true in the Anthropological department. There are also many exhibits that are very valuable in themselves as features in such a museum, but which do not have the intrinsic value to make it worth while to return them to their original location. To secure all these exhibits will make it possible for the museum to be among the most complete in the world in certain departments. Probably more than half of the finest exhibits in the Anthropological building and in the Mining building have already been secured, while valuable donations have been made from other departments. The only building on the grounds that is of such a permanent nature as to be suited to the purpose of containing such a museum is the Gallery of Fine Arts, which is constructed almost wholly of brick and structural iron, and which was built with this possible purpose in view. The Legislature of Illinois at its last session made it possible to retain this as a permanent structure by passing an act with this purpose in view. Some of the exterior ornamentation is of a temporary nature, but it can be remedied by putting

(*Continued on page 311.*)

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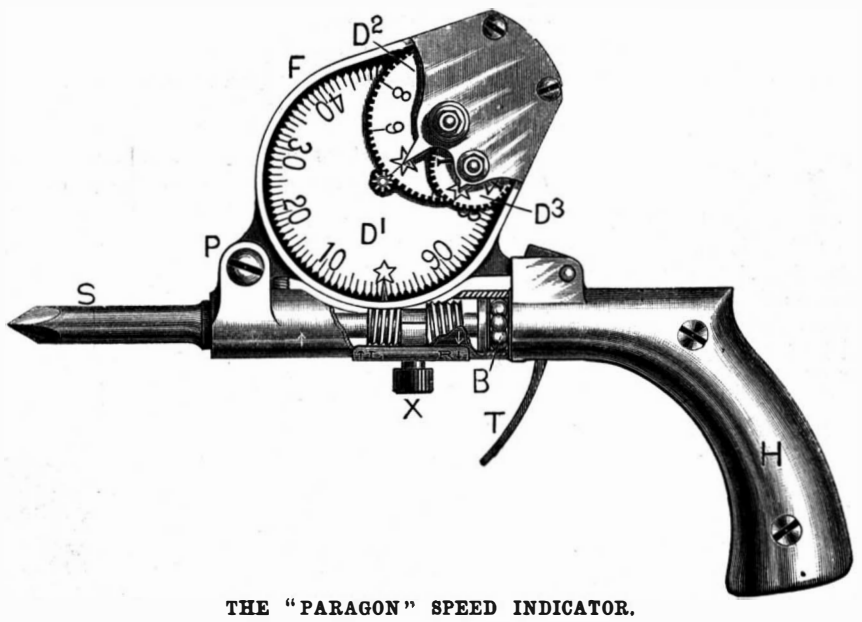
### THE "PARAGON" SPEED INDICATOR.

A very convenient and handy speed indicator is shown in the accompanying illustration. The device is made in the form of a pistol, which it closely resembles in appearance. The handle is grasped firmly in the hand of the operator, the point being pressed against the end of the shaft and the indicating mechanism is set in operation by simply pulling the trigger. This simple contrivance enables the operator to time the indicator with the hands of a watch with considerable nicety, while the form in which it is manufactured is convenient and the parts are simple in construction.

In the illustration, a portion of the tubular bearing in which the spindle revolves is cut away, to show the worm gear connections and the ball bearing at the inner end of the spindle which sustains the end thrust when the device is in use. The handle, H, is of pistol grip form, the spindle, S, being angularly pointed, with the inner ball bearing, B. The frame, F, in which the dial wheels, $D^1$, $D^2$, $D^3$, are mounted, is pivoted at P, so that it can be moved downward against the force of a spring to cause the teeth of the dial wheel, $D^1$, to engage with one of the worm gears on the spindle, S, the first wheel indicating units and tens, the second hundreds, and the third thousands of revolutions. By means of a thumb nut at the back of the dial frame, the dials are quickly and easily reset to zero, the star on each wheel being then opposite its pointer. A shifter slide, X, has two worms, one right hand and the other left hand, and this shifter may be moved to the right or left, as indicated by the letters R, L, according to the direction in which the shaft is running, whereby the revolutions may be counted by one set of figures, no matter in what direction the shaft may be running. The dial wheels are instantly brought into operation by pulling the trigger-formed lever, T, the releasing of the trigger instantaneously disengaging the registering mechanism, even though the spindle continues to revolve. An accurate registration may thus be obtained without even looking at the instrument from the time it is applied until after its removal. The device is strong and well made throughout.




THE "PARAGON" SPEED INDICATOR.

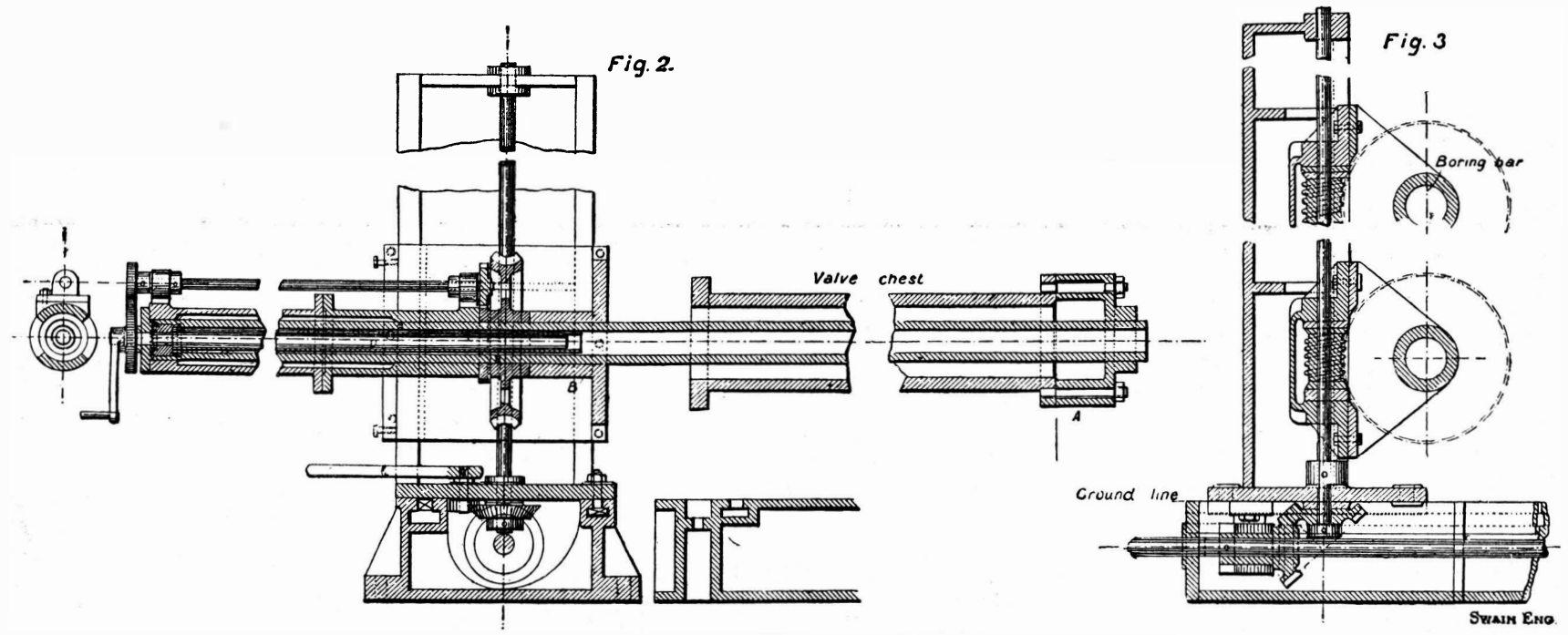
Further information in regard to it may be obtained of Messrs. Lintner & Sporborg, Gloversville, N. Y.

### BORING MACHINE FOR CORLISS ENGINE CYLINDERS.

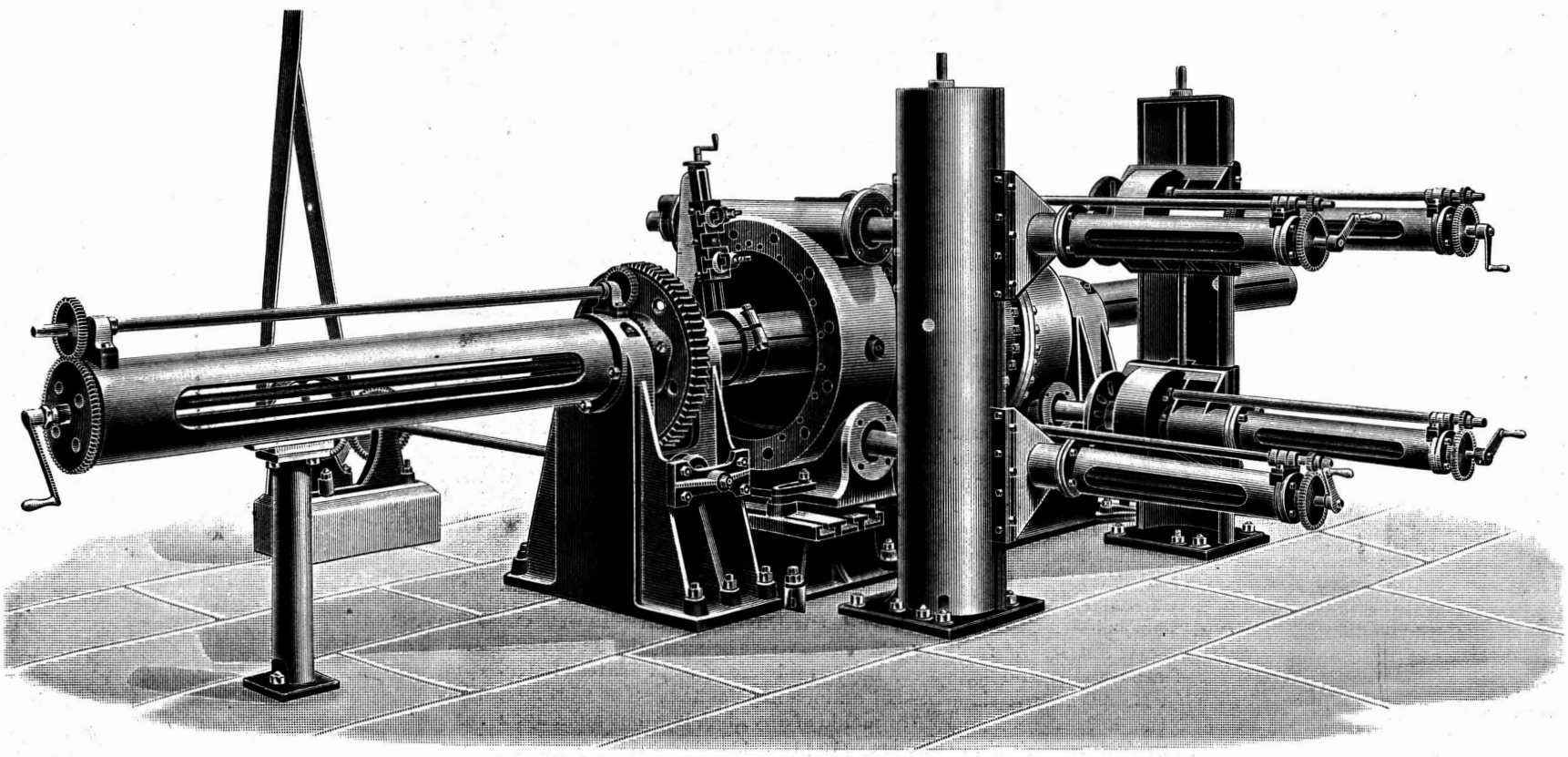
Herewith are illustrations, Figs. 1, 2, and 3, of a machine designed and constructed by M. H. Bollinckx, of Brussels, for boring the valve chests and cylinders of Corliss type engines at one operation.

The *Engineer*, London, to which we are indebted for our illustrations and particulars, says: "From the general view, Fig. 1, it will be seen that the machine consists of a horizontal bed plate, at each end of which stands a head supporting the boring bar and the driving gear. In front of the machine are two upright columns, on whose faces move four carriages, two on each, containing the driving and feeding gear for the four horizontal bars employed for boring the valve chests. We give sectional views, Figs. 2 and 3, of the gearing used in these carriages.

"In the boring operation the entire bar moves, being supported at its further or back end by the guide piece marked A in Fig. 2, a piece bolted to the valve chest face, and at the driving end by the long bearing constituting part of the actual carriage; the projected end of it enters the long sleeve extending backward from the carriage. This boring bar, it will be observed, is a tube—inside of which passes the feeding screw—passing through a plate at the end of the long sleeve, and having on its end the gear wheels necessary for automatic action, and the handle for manual use. The screw passes through a nut at the end of the bar, and is covered by an interior sleeve to prevent the entrance of grit. The bar is caused to rotate by means of worm gearing through the vertical shaft driven by the bevel wheels beneath the bed of the machine. The bar has a long key way cut in it, in which slides a feather attached to the worm wheel, and similarly for the worms themselves. There are two identical devices on each column, but they are independent, and can be placed in any relative position to each other, so as to accommodate many different sizes of cylinders. The columns also slide on bed plates by means of a rack and pinion worked by a spanner, and can be placed in positions closer together or further apart, in accordance with the demands of the cylinder.




CORLISS CYLINDER BORING MACHINE—SECTIONS



CORLISS CYLINDER BORING MACHINE.

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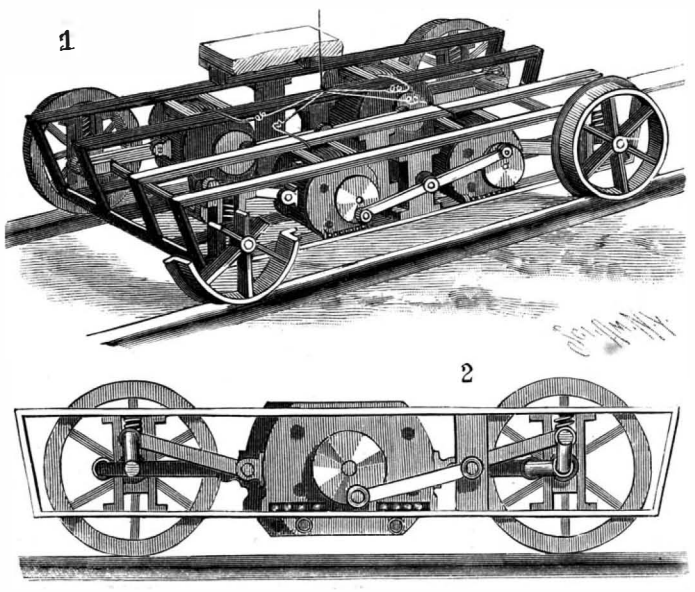
The gear for the boring of the cylinder is nearly identical with that described, only on a much larger scale. The few modifications will be readily gathered from the general view. In all cases the bar is entirely removable with facility. The method of using the tool is this: The cylinder having been placed on its face, is bolted to the bed plate, being blocked up to the right height for the main boring bar. The other four bars are then arranged in their places, their relative positions being adjusted by the insertion of a gauge between the two carriages on each column, and between the feet of the columns themselves. In the bars for the valve chests are mortise holes into which are fixed the tools for the first cut, which is made at a rate of from 12 feet to 16 feet a minute; they are afterward replaced by a milling cutter of the Brown & Sharp type, made in two parts for convenience, and ground to exact size, cutting at the rate of 10 feet a minute. The cylinder is bored in a similar manner, but on account of its size a collar has to be used, which, however, does not travel on the bar, but is carried forward with it. It is believed that better results can thus be got than by having a rotating tool holder on a fixed bar.

"This machine takes cylinders varying in diameter from 400 mm. (55 inches) diameter, with 800 mm. stroke (71 inches) up to 1·250 m. (49 inches), with 1·800 m. (71 inches) stroke. It is evident great saving of time must be experienced with a machine that thus performs five operations at the same time; the machine being carefully constructed, the four valve chests are bored perfectly parallel to each other, and the cylinder at right angles to them; the use of adjusted milling cutters and gauges for fixing the relative distances between the four carriages insures that all cylinders from the same pattern are interchangeable. The machine is therefore well suited to its work, and as the design is in no degree complicated, it is to be hoped that some good maker will take the matter in hand and produce here a tool for which Corliss engine builders will be thankful. In the engraving a tool holder employed for facing the cylinder flanges is shown; this is removed before the boring is commenced."




WILSON'S ELECTRIC MOTOR TRUCK.

### Kamela Dye.

In a handbook published by Mr. Thurston, an account is given of kamela dye, which produces a gorgeous flame color of varying shades, according to the process employed. The dye is a native of India and is merely the powder which coats the berries of the *Mallotus philippinensis* tree, which grows wild in many parts of the country. It is brushed off into baskets made for the purpose, and requires no further preparation, but the method of collection is very wasteful, as the trees are often felled in order to facilitate the gathering of the berries, and confidence is destroyed by the frequent adulteration of the article.

The red powder requires to be mixed with alkali, which, in Bengal, is obtained by burning plants, after which it is allowed to stand in water to extract the color. The silk to be dyed has only to be soaked in the mixture to make it take up the color, which is afterward fixed with alum. The dye has been submitted to the director of the Sericultural School at Como, who writes: "I think this color is fast and durable, but, nowadays, few persons care about durability, and dyers obtain the same dye with the artificial product called aroflavina, and with much greater facility."

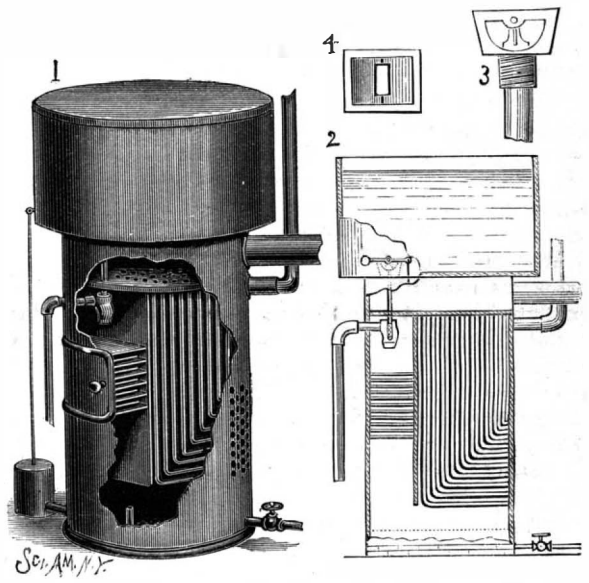
### AN IMPROVED ELECTRIC MOTOR TRUCK.

According to this improvement the motors are made to reciprocate and communicate motion to cranks on the car axles after the manner of a steam engine. The construction is the invention of Mr. James Thompson Wilson, of Tyrone, Pa. The car frame has suitable ways, with bearing surfaces provided with anti-friction rolls or balls, on which the motors are reciprocated in opposite directions, the cranks attached to their armature shafts being connected with levers pivoted to the car frame, and connecting rods jointed to the motors being connected with cranks on the car axle in the usual manner.

Fig. 1 represents a truck provided with four such motors, while Fig. 2 shows a two-motor car, the motors in each case reciprocating simultaneously in opposite directions, so that the reciprocation of one motor counteracts that of the other. The current is conveyed to the motors by conductors with flexible joints, the return current being carried through the car wheels and rails in the usual way, or when storage batteries are used it is returned direct from the motors to the batteries. The two-motor car may be made very light, and is designed to answer all the purposes of street car use, being especially advantageous where there are short curves in a line, having smooth action and giving sufficient speed for a city street.

### A HEATER AND CONDENSER.

To condense exhaust steam and use the heat thus obtained for the heating of buildings and other purposes, as well as to purify the feed water used in the boiler, are the objects of the improved apparatus shown in the illustration, recently patented by Messrs. Gueva G. Paull and Walter F. Brown, of Wilson, Kan. Fig. 1 is a perspective view of the improvement, with a portion of the shell of the condensing chamber broken away to show its interior, Fig. 2 representing a transverse section. At one side of a vertical partition extending nearly to the bottom of the condensing chamber is a series of L shaped air pipes leading from the outside to a partitioned-off space at the top, from which a flue extends either to the rooms to be heated or to a connection with a suitable exhaust fan, insuring a constant passage of air through the pipes. At the top of the space on the other side of the vertical partition the exhaust pipe from the engine is connected with a downwardly discharging exhaust head, into which also extends the perforated nozzle of a water supply pipe, connected with a pipe valve in the water supply tank at the top. This valve, shown in detail in Figs. 3 and 4, has a segmental valve seat, and the valve is held on a shaft extending through one side of the tank, there being on the outer end of the shaft a weighted arm connected by a rod with a float in a closed vessel connected at its lower end by a pipe with the lower portion of the condensing chamber. From the bottom of this chamber an outlet pipe extends to the feed pump, the inner end of the pipe being bent upward to prevent the entry of sediment collecting on the bottom, but when the water rises above the desired level it flows through the pipe into the vessel containing the float, and the raising of the latter operates the valve to shut off the supply of water from the tank at the top. A series of spaced purifying plates is arranged, one above the other, beneath the exhaust head, and the entering water and steam pass through these plates, depositing thereon their impurities, the steam not condensed rising around the air pipes on the other side of the vertical partition. A pipe leads to the outside from the top of this space, so that the uncondensed steam will always have a free passage off. A door affords convenient access to the purifying plates that they may be readily cleaned, and in the bottom of the condensing chamber is arranged a blow-off pipe to facilitate the removal of sediment.




PAULL & BROWN'S HEATER AND CONDENSER.

### MECHANICAL ARITHMETIC.

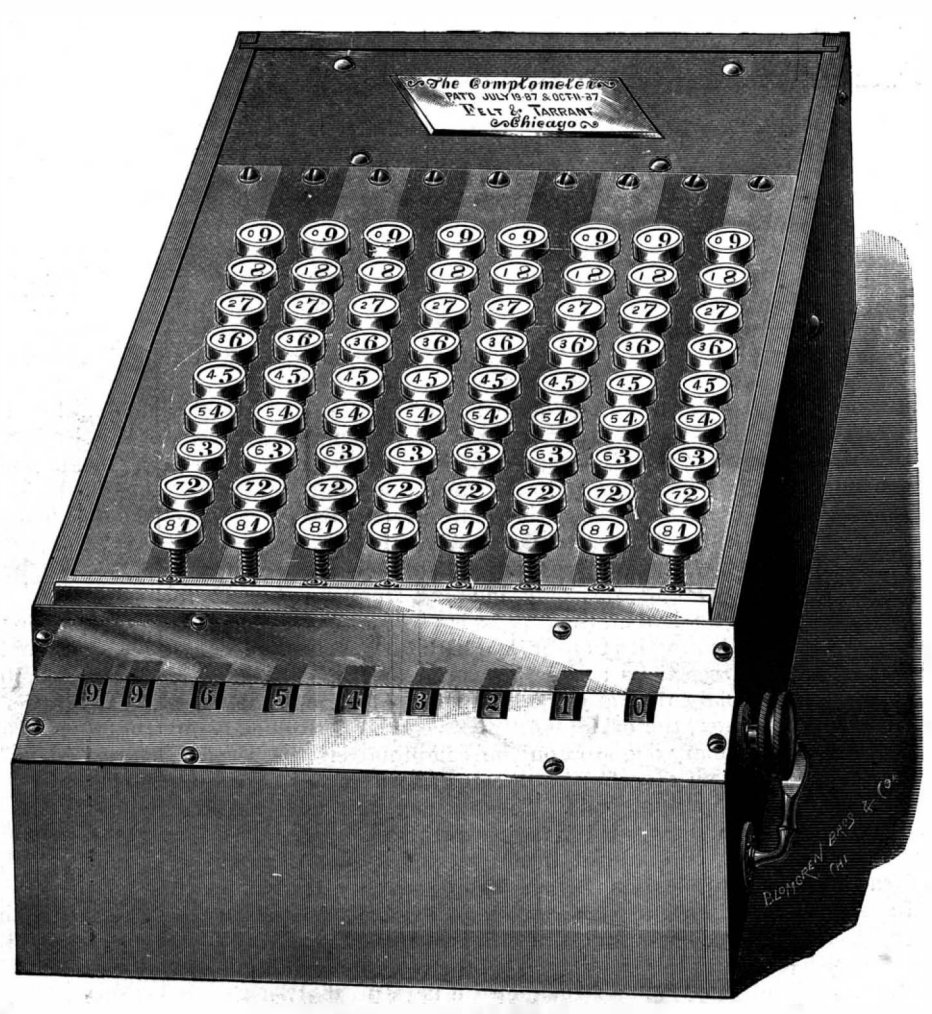
BY DORR E. FELT.

"Mechanical arithmetic"—is not all arithmetic mechanical? At least every arithmetical computation consists of enumerating numbers or quantities of units whose dimensions are determined by some mechanical means, and it is said that our system of enumeration by tens is the outgrowth of the mode of counting and expressing on his fingers such simple numbers as the early half-savage man could comprehend, and to-day the great government and insurance actuaries all over the world use mechanical appliances of various kinds to perform their arithmetical calculations. Since counting started in a form of mechanical arithmetic—counting on the fingers—it would be a wonderful illustration of the circle in which affairs move if mankind, after centuries of mental arithmetic, should again come back to mechanical arithmetic, and it in a very high state of development become the common mode of making all kinds of arithmetical calculations. Such a consummation is not impossible, in fact, recent inventions in calculating machines indicate that it is probable.

Perhaps the branch of mechanical arithmetic most widely known is the little frame of parallel bars with balls sliding thereon, the abacus, on which the Russian and the Chinaman count sums with a facility that seems to us surprisingly rapid, though upon investigation this method seems to involve too much mental work mixed with mechanical work to commend it to the Caucasian, for mental and mechanical arithmetic do not mix very well.

Either alone is better than a mixture of the two. Perhaps the next most widely known calculating instrument is the one which was devised by Babbage, a famous English scientist and writer, backed by the British government to the extent of £20,000 which he sunk in addition to a part of his private fortune in an endeavor to make it work, but he never completed it.

This machine was intended for calculating tables by means of ratios of common differences, particularly for




FELT'S COMPTOMETER.

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calculating tables of logarithms. Doubtless his theory was correct, but he lacked the mechanical ability or assistance to devise mechanism which would properly actuate the numeral wheels. The *Temple Bar Magazine*, of London, is authority for the statement that on one occasion Count Strezlecki remarked to Mr. Babbage that in China, where he had lately been traveling, they took a great interest in his calculating machine, and particularly wanted to know if it could be put in the pocket. "Tell them," replied Mr. Babbage, "that it is in every sense an out of pocket machine." This remark will doubtless apply to nearly every calculating machine ever worried over by a fond and hopeful inventor, because of the great mechanical difficulties met with in inventions of this kind which do not appear on the surface.

One great failing of inventors of such machines is, they seem to think if they only get something to do the work mechanically, it does not matter about the speed, rest to the mind being all that is necessary; but one who tries to sell a calculating machine which is not more rapid than the mind soon finds that the living world regards time of first importance, and is willing to sacrifice its brains and put up with mistakes rather than lose present time, regardless of the fact that it may be losing time by shortening its lives on account of overtaxing brains and turning men into veritable machines, until, as Wendell Holmes put it, "you would almost hear the clicking of machinery inside their heads." I have often wondered if he was thinking of calculating machinery or only recognized the mechanical future of arithmetical operations even when performed mentally. Another machine for calculating tables by means of common differences or ratios was exhibited to the Prince of Wales in June, 1855, and attracted considerable attention at the time. It was the invention of Edward Schentz, of Stockholm, and not only calculated the tables, but automatically cast stereotypes as fast as computed, from which the tables were printed, so that there could be no mistake in setting type. I believe that a modified form of this machine was eventually used to a great advantage in computing a book of logarithms, though, as yet, I am unable to find any authentic information on that point.

In a class by themselves may be placed the several crank-operated machines for multiplying and dividing which have been invented and sold with more or less success, according to the commercial ability and enterprise of their manufacturers. These machines are alike in mode of operating, differing only in their mechanisms. They all have several series of number indexes, running from one to nine, each standing for an order of numbers, and pointers for each index, which, in use, are set on the indexes, each to correspond to a figure of one of the factors of a problem to be computed, and a crank, which is turned a number of times to correspond with each respective figure of another factor of the problem to obtain the required answer. These are very good in certain classes of large examples, being very much better than the head.

Among the more prominent of this class of machines are those produced by Thomas, of France, and improved and manufactured by Tate, in England; that of Odhner, of Poland, a small and light machine which has not been much pushed in this country; that of Baldwin, of St. Louis, Mo., and Grant, of Cambridge, Mass.

In this country more attention has been paid to adding machines, of which the writer has knowledge of over fifty, not counting something like 150 cash and fare registers and numerous counting machines which have been patented, only a few of which have ever come into practical use. Most of these adding machines would not work accurately in practice. A few simple contrivances which could be made cheaply have been put on the market and have found quite a sale, because they were cheap, and many, dreading the mental strain of figures, would risk a small amount of money with the hope of escaping it.

In the accompanying cut will be found a computing machine of my own invention, known as the comptometer, which is operated by keys like the better class of typewriters. A large number of them are now in use, not only in this country, but in Europe, India, South America and Mexico. This machine is peculiar to itself and is wholly unlike any other calculating machine in the world, both in mechanism and manner of operation.

In using it the operation is wholly mechanical, one only having to touch keys corresponding to the numbers of the example and the machine does the rest, the carrying being done automatically by the machine and requiring no attention from the operator.

In addition the operator only has to strike one key for each figure, the same as an operator on a typewriter, and sixty words is not an extra speed for typewriter operators, which, figuring five letters to the word, is 300 keys. I have seen that speed reached on the comptometer; hence it is fair to say that a properly designed adding machine is more than twice as rapid as mental adding. No mental adder can begin to keep up with it when skillfully operated for ten minutes, or even for one minute, while for a stretch of several hours there is no comparison between a mental adder and it.

All the columns are added at once. The figures of each respective column on the paper are struck in the corresponding column of the machine.

The standard size has a capacity of eight columns (99,000,000), though larger sizes are made. As shown in the cut, there is a series of keys for each column of numbers, and the first on the right stands for units, the next for tens, the next for hundreds, etc., just the same as they are ordinarily written on paper. The register or place where the answer appears is just below and in front of the keys. In speaking of the keys, those running in a line up and down are called a column and those running in a line from left to right are called a row. Thus all the keys having a large 4 on top stand in a row and are called the row of 4's.

To perform multiplication on the comptometer, the operator begins at the right or the row of keys indicated by the first figure of the multiplier, and strikes each successive key in the same row toward the left as many times as indicated by the corresponding figure in the multiplicand, and then proceeds with each of the other figures of the multiplier as with the first, beginning always in the column of keys in which the figure of the multiplier stands.

Since the operator does not have to jump around from one part of the keyboard to another, always working in straight row, only jumping from one key to its next neighbor, the process is very simple, and requires little practice to acquire a high degree of speed.

Operations are performed on the comptometer so rapidly that any method is rapid enough. For instance, the example 718 × 423 can be performed by an ordinary operator on the comptometer in 4 seconds, and an expert operator can perform it or any similar one in 2½ seconds. Theoretically, this does not seem possible, but it is a fact nevertheless.

It is doubtful if one having a book of tables of multiplication before him, even if already opened at the right page, can, on an average, locate the answer in 4 seconds, or twice that time.

In dividing on the comptometer the number to be divided is first struck on the keys precisely as in addition and then the divisor is struck with respect to the smaller figures on the keys, which are red, the operator striking the proper keys continually (never more than nine times) until the figures in the complementary place agree with the number of strokes on the keys, and the thing is done.

It is a significant fact that the Cornell University, a school specially famous for its mathematics, is using four comptometers.

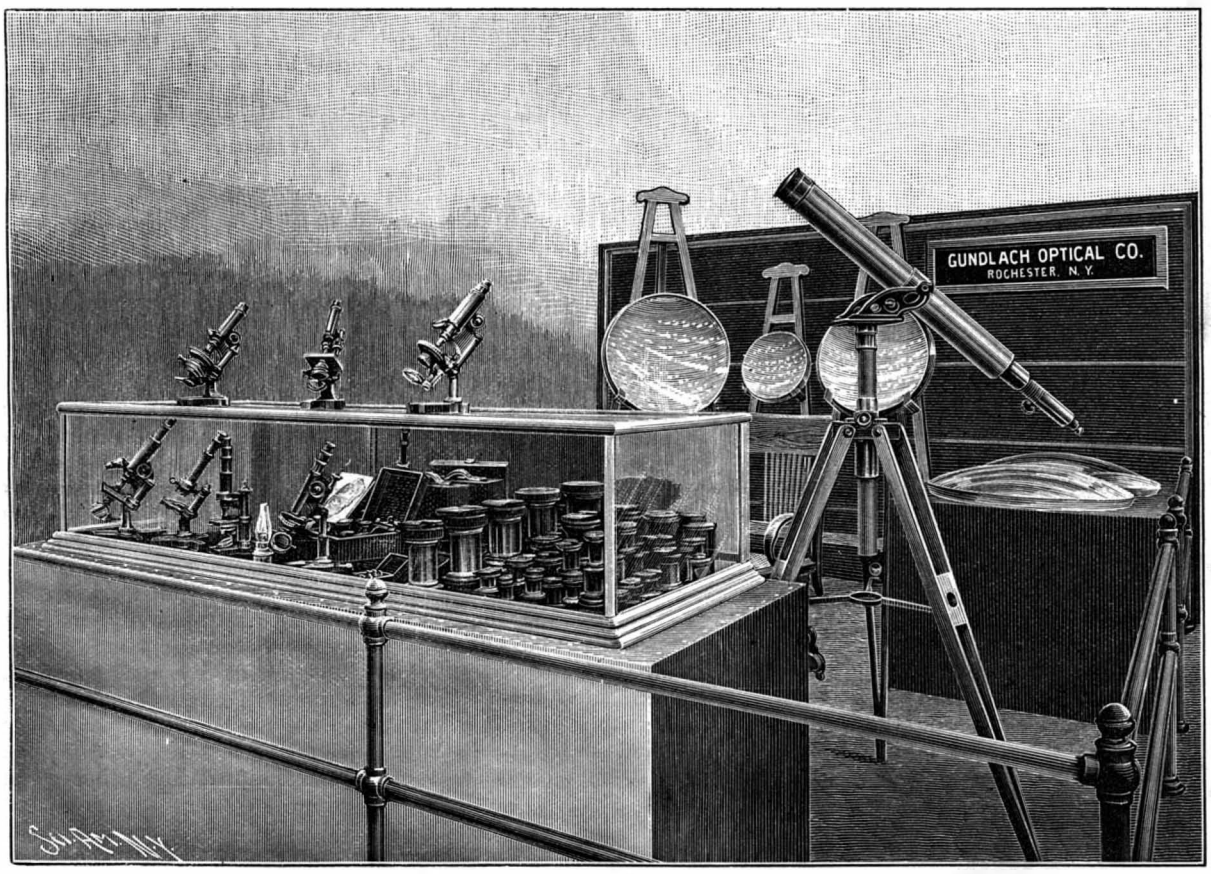
Its keyboard stands a simple and complete diagram of the very system of notation itself. Every key standing to represent a corresponding rung of the ladder of numbers and each key when touched affecting the register for results according to the numeral value for which it stands.

Having this, you have a machine which will rapidly compute addition, subtraction, multiplication, division, square and cube root, by the application of which everything in arithmetic is calculated.

Though it is less than four years since the Felt & Tarrant Manufacturing Co., 52, 54 and 56 Illinois Street, Chicago, started to manufacture the comptometer, its business has increased until its large factory fitted throughout with special machinery for manufacturing comptometers, is continually driven to its fullest capacity to fill orders.

## OPTICAL GOODS AT THE EXPOSITION.

The accompanying illustration represents one of the most notable exhibits at the World's Fair, that of the Gundlach Optical Company, of Rochester, N. Y., a company which ranks among the leading manufacturers of optical instruments of the world. Three awards were made to this company for the excellence of their goods. The business had a very modest start about ten years ago, with the optical work of Mr. Ernst Gundlach as a basis. From Mr. Gundlach the firm took its name, and he is still connected with it as consulting optician, while the firm proper consists of Henry H. Turner, John Zellweger, and John C. Reich. Microscopic objectives were the first articles manufactured, but the firm was brought into especial prominence by the superb line of photographic lenses which they originated and placed on the market. These lenses are of peculiar construction, and are protected by letters patent. They are so constructed as to eliminate to a great degree the defects which are inherent in all photographic lenses. In addition to this, they are so constructed that either the front or back combination can be used as a separate objective, and a longer focus thus obtained than the combined objective gives. In this way lengths of focus can be secured varying as 2: 3, and 4. A year or two ago the firm added the manufacture of portable telescopes and microscope stands to their business, and at once took a prominent place in both these lines. In the microscope department they received two awards, being the only firm in this country to receive any awards in this line. The microscopes embrace a wide range of instruments, and are all made on the most approved models and with the greatest attention to detail and excellence of workmanship. The portable telescopes are also receiving deserved recognition, as they are of the highest optical excellence, and mechanically have many new features for portable instruments. They are made in size from 2½ inches aperture up. Many are in use in various parts of this country, while the company is preparing to fill a European order.




THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE GUNDLACH OPTICAL COMPANY.

One of the unique parts of the exhibit is the fine display of Mangin mirrors, such as are used in the great marine search light projectors. This firm is the only manufacturer of these mirrors in America. The mirrors vary in size from 30 to 75 centimeters, and one requires some knowledge of the *technique* of the glass business to fully appreciate the great difficulties encountered in their manufacture. The exhibit as a whole was a most complete and satisfactory one.

CITRIC ACID BY SYNTHESIS.—Charles Wehmer.—The author obtains citric acid by the fermentation of glucose set up by certain fungi, *Citromycetes pfefferianus* and *C. glaber*. Herr. Wehmer states the spores of these fungi are abundant in the air, and can be obtained pure by cultivation.

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### Notes from the World's Columbian Exposition.

(*Continued from page 307.*)

a new surface on the building at not very great expense. The building is regarded as one of the masterpieces of architecture of modern times, and its location at the north end of the lagoon is an ideal one.

Several forthcoming expositions in different parts of the world have taken the opportunity to advertise themselves at this Exposition. The coming Midwinter Fair at San Francisco has sought every possible opportunity to make known some of the special features that it will have, and the International Exposition at Antwerp, Belgium, which is to be held from May to November, 1894, has been seeking to secure exhibits as well as attendance by making known its attractions. A national exposition is to open at Kyoto, Japan, in April, 1895, and a picture of the proposed buildings and grounds, with some information regarding the exposition, formed a noticeable feature of the Japanese exhibit in the Manufactures and Liberal Arts building. This exposition is to be held to commemorate the 1,100th anniversary of the establishment of the city of Kyoto as the capital of the Japanese empire.

A feature of some interest, says the *Electrical World*, regarding the relative sizes of dynamos and machines which are used to drive them is shown quite nicely in some exhibits at the World's Fair. In all cases where there is direct driving, or where a single engine drives a single dynamo, it may be assumed that the dynamo and its prime mover are practically of the same horse power. When the prime mover is a steam engine, it will be noticed that the difference between the sizes, floor space, etc., of the dynamo and the engine is very greatly in favor of the former, the proportions being, perhaps, roughly, about as one to three, or at least as one to two; if the boiler is included with the steam engine, as it should be, the difference becomes very much greater. This shows that, besides being a much more efficient transformer of energy, the dynamo has a very much greater output per pound, per volume or per square foot of the floor space, than the steam engine, especially when the boiler is included. The lower the speed, the greater this difference seems to be; or, in other words, the engine seem to decrease less in size at higher speeds than the dynamo. But we noticed that the case was different in the high-speed water wheel that drives the dynamos in the General Electric Company's exhibit; here the dynamo and the water wheel appeared to be very nearly the same size. On making a comparison in the case of the high speed steam turbine, exhibited in the Swedish department in the Machinery building, we noticed that the tables were completely turned, and that here the relative sizes were just about the reverse of what they are in the case of the usual steam engine. Here a small eight inch wheel (illustrated in SCIENTIFIC AMERICAN of October 21, 1893), running at a speed of 20,000 revolutions per minute, developed 20 horse power, if the statements made to us were correct, and we have no reason to believe that they were not. It is needless to say that the dynamo which it was driving was far greater in size, even the gearing for reducing the speed down to one-half occupying a much greater volume than the engine itself. If, however, the boiler is included, the difference is again in favor of the dynamo.

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### RUSSIAN EXHIBITS.

(*Continued from page 291.*)

The statistics in regard to illiteracy in Russia are so familiar that we are hardly prepared to find her exhibit in the educational department so extensive. There are many portfolios of views of different schools, showing fine buildings, spacious rooms and many students. Herbaria collected by scholars are placed beside the needlework which is conspicuous in the exhibits of all foreign schools.

The Central School of Design, founded by Baron Stieglitz at St. Petersburg, has very interesting work to show, including designs in color for weapons, vases, lace and gold plate for ecclesiastical use.

The prominent place assigned to the Marie Educational and Charitable Institutions, "under the immediate patronage of their Majesties the Emperor and Empress," gives one a desire to know what they accomplish, and the documents which are included in the exhibit furnish much interesting information. It was upon the accession to the throne of Catherine II that attention was first given to the education of women. The history of the movement then begun, the methods used to extend it, and its extraordinary outcome, are not without their lessons for the student of sociology. It may thus briefly be told: In 1764, an "Educational Home for Girls of Noble Birth" was established by the Empress, and within a year a school for girls of the middle class was opened in the same convent, by royal decree. The studies pursued in the first school were religion, three languages besides Russian, music, drawing, arithmetic, dancing, sewing, and knitting. The higher class gave some attention to architecture, heraldry, history, and literature.

For girls of the middle class more instruction was provided in needlework, cooking, and weaving and less in books. A year previous, the Empress had opened a large foundling hospital in St. Petersburg, and one in Moscow. The philanthropist Betski, who from the beginning of the educational enterprise gave valuable aid, and who planned these hospitals, had difficulty in getting all the money necessary to carry them on. To this end he organized auctions and savings banks in both these cities, the revenue from which was devoted to the maintenance of these institutions. Tickets of admission to places of amusement were taxed for their support, and playing cards were made and sold exclusively for their benefit.

In 1774, Prince Demidoff gave 205,000 rubles toward the foundation of a commercial school for boys of the mercantile class, and this was attached to the Moscow foundling hospital. When, in 1796, after the death of Catherine, Marie Feodorovna became Empress and the head of the girls' schools, she endowed them with an annuity of 15,000 rubles from her personal income, and made many changes in their management. She altered the courses of study, and reformed the conduct of the hospitals, savings banks and commercial schools. Then she began to widen the scope of the work in many directions. At her death in 1828, she had established the Kharhof Institute, to which merchants' daughters were admitted, two schools, one at Nicholaieff and another at Sebastopol, for daughters of sailors, and two for daughters of soldiers; a school for the deaf and dumb of both sexes; another foundling asylum, and homes for widows of men in the civil service. The Empress Marie took most active personal interest in these institutions, visiting class-rooms and learning to know the scholars. In memory of her, all the institutions—those founded by her predecessor as well as her own—were made by royal decree the Marie Institutions.

The Emperor Nicholas established government schools for girls of noble birth in provinces most remote from the capital. He also founded orphan asylums, but so far all the schools were for boarding pupils. It was not till 1858 that public day schools for girls were started. They were soon multiplied in towns which asked permission to establish them without government aid, but only those receiving a subsidy from the government are included in the Marie Institutions. Of these, there are now 472 scattered all over the empire; in the year 1891, they aided or relieved 498,108 persons; of these, only 27,417 were in the schools; the others were in the hospitals, asylums and hospices. In the foundling hospitals, 24,424 illegitimate and 579 legitimate children were received, and for them 107 elementary schools were maintained.

A pamphlet which was given me tells the history of the educational movement on behalf of the emancipated serfs, begun in 1861. It took the form of Sunday schools for adults. In two respects they resembled our Sunday schools—the teachers were volunteers and unsalaried, and the pupils were taught in groups. Men and women from the upper classes of society gave themselves enthusiastically to the work, which extended from the centers into the provinces. But, before the first decade had passed, political reasons led to the closing of nearly all of the schools. Finally, but one was left, that at Kharhof, a school for women: this survived because it was maintained by a lady at her own expense. It has now seventy teachers, and three hundred and fifty pupils attend it annually. Since 1880 more liberty has prevailed, and similar schools for both sexes have been opened in many provinces, even in remote hamlets; in St. Petersburg and Moscow it has been done by the municipalities. At present one hundred thousand scholars are at work under ten thousand teachers.

The instruction in the Kharhof school is in reading, writing, the elements of grammar, arithmetic, religion and the Gospel. The scholars are in groups; their ages range from six to forty-five years. The session lasts from ten in the morning to two in the afternoon, with short intervals of rest. At the close of the session, books from the library are given out; these books, some of which are prepared expressly for the purpose—written down to their capacity—are carried to the homes. It has become the custom for neighbors to gather to hear these books read, and thus the influence of the school reaches far beyond the pupils.

The postal service exhibit is curious; its chief value, perhaps, is to impress upon the visitor the extent of the empire and the widely differing conditions which exist in the different sections. For instance, here is the miniature model of a Siberian mail wagon in the form of a sled drawn by seven tiny dogs; one man drives them and another guards the mail; again, a sledge is the vehicle and a reindeer the power. In Archangelsk, we see the mail carried in a boat rowed by four women, while a man at the helm guards the precious box. The Caucasus Mountains are represented in miniature; on the lower heights a camel, loaded with five bags, is conducted by two men; but in the upper regions, where snow and ice offer serious obstacles, a procession of men is shown. The one in advance carries a pick; the second, a shovel; the third, the mail bag; the fourth and fifth are armed with swords.

It is a significant exhibit, when we consider how much it has cost to send these little figures from the other side of the globe, and set them up here in life-like attitude and suitable environment.

Photographs of bridges, drawings of various internal improvements, and the monograph of Lieut.-Gen. Jilinsky on "Irrigation in the South of Russia," are other evidences of the progress of the empire.

In comparison with Germany, Russia's display in the Mining building is small, but a book case filled with bound volumes of mining reports from 1881 to 1892 is evidence of the extent of the industry.

Nobel Brothers make a large exhibit of petroleum and the derivative oils, from their refinery in Baku. A most interesting one is that of the Briantzewka mine of rock salt and soda. It is near the town of Bakhmont in the government of Ekaterinoslaw. The mine is worked by a company, some of whose members are noblemen, under imperial sanction. The four shafts are from 120 to 164 meters deep; 600 men are employed, and last year's yield was 150,000 metrical tons; these are, in brief, the statistics given. In the show case, there are large and small cubes of salt, a pyramid and fragments in jars, and photographs of the mine. A neat and complete model of the extensive Votkinsky Iron Works in Ural shows the buildings and grounds in minute detail; they form a good sized village. There are samples of steel and iron castings, and models of farming implements and ships built there. From one point of view, the most interesting exhibit is that of the Slavianoff electrical welding process. A table is sometimes covered with broken articles; a cast iron pulley, broken into many pieces; a steel shaft; teeth of a spur wheel; copper tubes; the necks of shafts and other similar castings have all been repaired by this new and secret process of welding by electricity. The chemicals used in the process are inclosed in a case under glass; from their appearance, it is easy to guess what some of them are, but their names are not obtainable. The works where the process is carried on are at Perm in the Ural. The only distinct reference to the Siberian mines, with their broken-hearted toilers, that I could find is in the form of three immense yellow cubes piled in a series, showing the relative production of gold in West Siberia, East Russia, and East Siberia from 1845 to 1891. The largest one represents the amount found in East Siberia, 1,097,232 kg.

In the Fine Arts building, the Russian exhibit occupies a large and a small room, opening from the south court in the central pavilion. It is sent mainly, according to the catalogue, by the Imperial Academy of Fine Arts, which owns some of the pictures.

Among the few pieces of sculpture may be mentioned a bust of Count Tolstoi and statuettes of Tchaikoffsky and Vereschagin, by Gunzbourg. His representation of the soldier-artist is very life-like and true.

An art critic is my authority for saying that the painters show much boldness in the use of color and skill in general technique. It is impossible to escape being deeply impressed by several of the pictures. Among these, that called "Grandmother and Granddaughter," by Tvorojuikof, should be mentioned. It represents an old woman with something slung over her bent shoulders, and a large, coarse muffler tied over her head. The child's head is covered in the same way, and her hands are hidden in the long sleeves of her loose coat. They stand close together, the little girl in the forefront of the canvas, in a dreary spot, near a few dried grasses and leafless bushes, with a waste of snow beyond them. Dull faces they have, and the scene is probably typical of their lives.

No picture is, to me, more impressive than that named "Christians awaiting Death after the Free Supe" It is by Theodore Bronnikov, a native of Siberia. The scene is at night; the only light in the long room where it is laid comes from a hanging lamp in one end. A procession seems to be entering the room, and another to be passing out. The most conspicuous figures are those in long flowing white robes. One of these, a man, is the center of the group in the foreground; his countenance is radiant; with one hand he points upward, the other is outspread toward the sorrowing ones gathered about him. An old woman, with agonized expression, is clasping his neck; a young woman kneeling at his feet holds a baby toward him; another form, perhaps that of a daughter, is also at his feet, with her face hidden in his garments. I have not known where to find an explanation of the historical significance of the picture, and I wish that some one who may chance to read this inadequate description of the solemn scene would be kind enough to supply it to the SCIENTIFIC AMERICAN. "A Drowned Man," by Dimitriev-Orenburgsky, is a work of merit. A group of men in a variety of costumes and in most natural attitudes is gathered about a form prostrate on the edge of a stream. At his head stands a man with sleeves rolled up and legs bare, evidently the one who went to the rescue. The interest of the spectators is divided between him and the poor fellow on the ground.

"The Moscow Rag Fair," by Vladimir Makovsky is a most animated scene; evidently an entire square is occupied by the venders of old clothes, and an eager

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bustling crowd is gathered, full of action and color and suggestion for the moralist.

"The First Born," by T. A. Pelevin, is one of the few pictures in the collection that brings a touch of lightheartedness to the beholder.

In a little peasant's cottage, where garments and kitchen utensils are side by side on the wall, a young mother is holding her baby, and the kitten is creeping into the warm cradle beside her. The little hands are raised, the face is full of smiles, and the mother's seems lit from the glow of the baby's eyes.

In general, the pictures intensify any previous notion one may have had of the seriousness of life in the Czar's dominions.

Nearly all the subjects are national, but Ivan Constantinovich Aivazovosky has ventured into foreign fields. (What might not a man with such a name venture?) His five large paintings of scenes in Columbus' career show much power. No 106 is the Santa Maria in a storm when the dauntless leader is surrounded by his crew in mutiny. No. 107 is Columbus landing with his suite at San Salvador. No. 108 is a scene from his early life, when as a youth he saves himself on the mast of a mercantile ship which has been set on fire off the cost of Portugal by a Venetian galley. No. 109 is Columbus' farewell in Palos, and No. 110 the arrival of the flotilla on the American shore. If one would like a series of sensations, novel if not bewildering, let him on the same day visit the Santa Maria, moored beside the peristyle, the convent of La Rabida with its portraits of Columbus, for whom a dozen or more men might have sat, and then look at these canvases aglow with fierce color and terrible with the storm of sea and angry men—a Russian's interpretation to us of the life of our discoverer.

My strong impression of the labor, thought, ingenuity and expense which have made the foreign exhibits so valuable has deepened every day. Never, I think, was the brotherhood of man taught in a more forceful way than at the Fair; and, notwithstanding the bickerings and disappointments attendant upon its management, it cannot fail to result in closer bonds between the scattered families of nations who for these summer months have been represented in the White City.

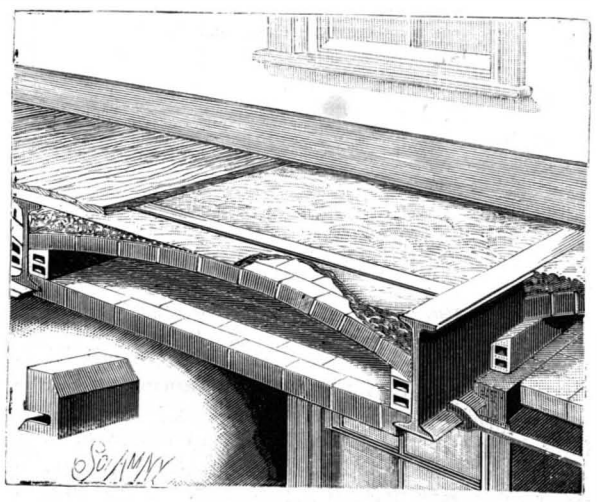
A. DINSMOOR.

### Pixol, a New Disinfectant.

The *Lancet's* Russian correspondent cites a report published in a supplement to the *Army Medical Journal*, by Dr. Eberman, on pixol, a cheap disinfectant introduced by Dr. Raptchevski. It is prepared by dissolving a pound of green soap in three pounds of tar and slowly adding a solution of a little over three ounces and a half of either potash or soda in three pounds of water. At the time of using, one part of the sirupy liquid thus formed is added to nineteen parts of water, forming a five per cent solution of pixol, and it is used of this strength for disinfecting linen and for washing the hands; for the disinfection of dejecta ten per cent solution is recommended. Such a solution has been proved to be fatal to the *Bacillus anthracis*, to the bacilli of typhoid fever and cholera, and to the cocci of suppuration. It is said that the preparation costs only about two cents a pound.

### IMPROVED CONSTRUCTION OF FLOORS, CEILINGS, ARCHES, ETC.

The illustration presents a combined floor, arch and ceiling, in which the ceiling is flat and the floor support arched, but with a large air chamber between the floor and ceiling, the construction being of great



DE RACHE'S FLOOR AND CEILING ARCHES.

strength and such as to effectually deaden sound. The improvement has been patented by Mr. Pierre J. L. De Rache, known as Leonard De Rache, of No. 755 East 141st Street, New York City. The floor and ceiling are arranged between parallel I beams or girders of the usual kind, but the blocks, which bear upon the lower flanges of the girders and which come at the ends of the courses, are recessed to fit snugly upon the flanges and have lips which project beneath the girders, so that a key may be inserted between the lips of opposite and adjacent bearing blocks, thus covering the girder bottom and making a smooth finish. On the bearing blocks next the girders are supporting blocks or skewbacks, which support the end blocks or tiles of the series forming the arch, or the ends of the arches may, if preferred, be made to bear directly upon the bearing blocks. A different form of bearing block, with lip fitting the bottom flange of the I beam, is shown in the small figure, the girders with this construction, being preferably placed parallel with each other, and a tie beam or bar extending between the ends of the arch, thus increasing the sustaining power of the floor.

The advantage in this system of construction is that any kind of bricks or partition blocks, hollow or solid, may be used, but the hollow ones are preferable, on account of their lightness.

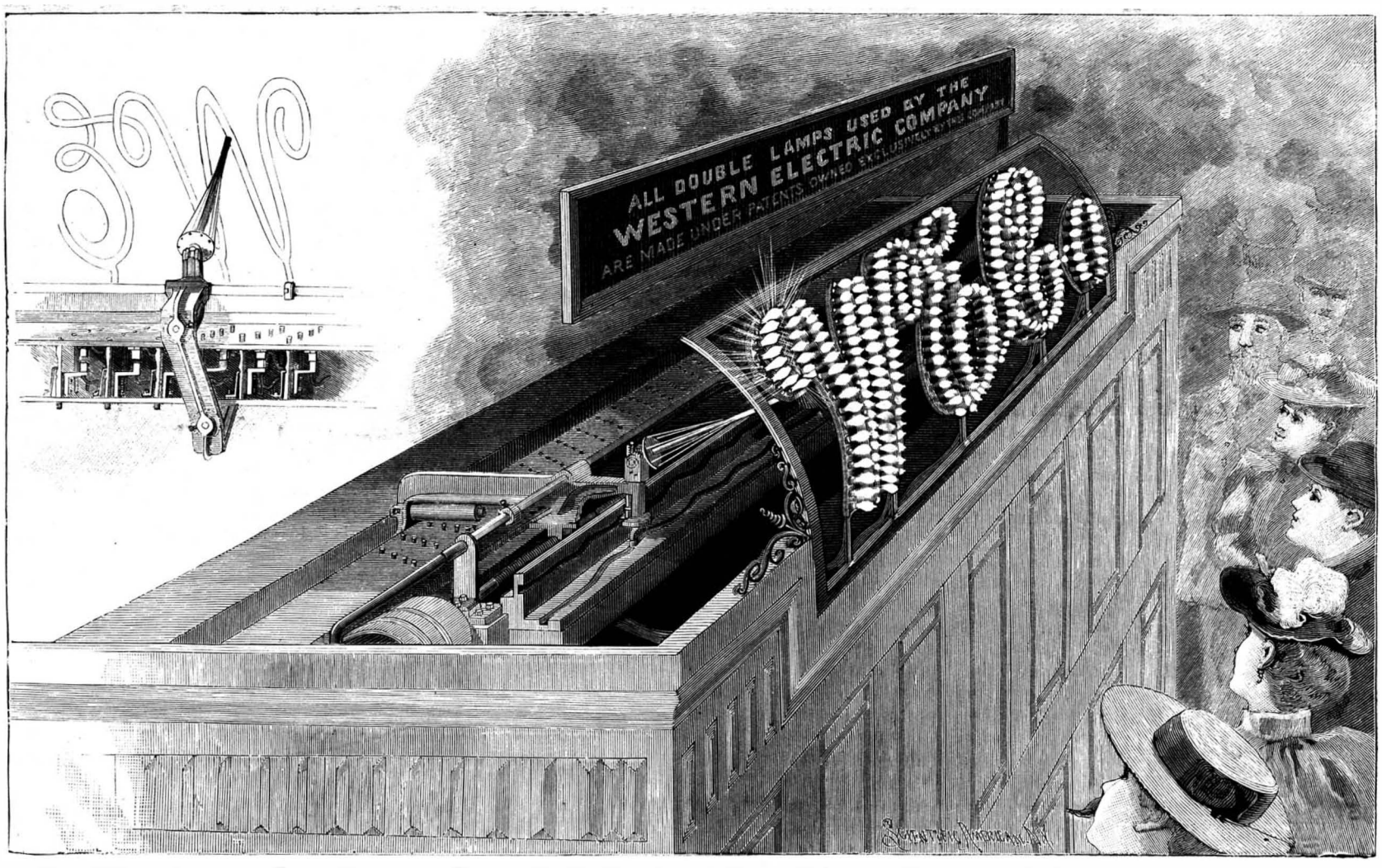
### WESTERN ELECTRIC COMPANY'S LUMINOUS SIGN.

One of the exhibits of the Western Electric Company at the Columbian Exposition received a great deal of attention from the general public. This exhibit, while in the line of what theatrical people call "business," was really remarkable in its ingenuity and construction, and answered the purpose of attracting the popular mind. It appeared like a veritable writing on the wall. It consisted of a series of lamps arranged as shown, to give the initials of the company's name in script outline. These lamps apparently are lighted and extinguished by means of a wand that moves mysteriously along the path of the letters at their rear, and which, although it does not touch the lamps, seems to exercise some magic influence and causes them to break out into a brilliant glow. It moves forward on its journey, writing on the air the letters W. E. Co., and as it moves along the lamps become illuminated. When it has reached the end of its journey and lighted all the lamps in the series, the wand begins deliberately to move back in the reverse direction but in the same path, and extinguishes each lamp as its point passes by. The movement of the wand is automatic and the precision of its movement renders it fascinating to watch. As a matter of fact, the only part that the wand has to play in this little comedy is that of heightening the illusion. It really has no function to perform beyond bewildering the uninitiated. The real secret of operation of the apparatus is not understood until the beholder has abandoned this idea and has grasped the fact that each lamp is connected with the operating table or switchboard, separately. Then all becomes comparatively clear, and he will be ready to have explained to him the details of operation which are rendered comparatively simple by having exposed to his view the internal mechanism, as appears in our illustration.

The wand or pointer is mounted on a slide rest or carriage, so that as the slide rest is traversed by a feed screw back and forth from right to left and left to right the pointer is automatically moved, so that its end, by a species of pantagraph mechanism, follows exactly the outlines of the letters. Its motion in doing this is controlled by two sinuous grooves in planes lying at right angles to each other. These planes, with their grooves, are seen below the base of the pointer. Each groove receives a projecting piece, which, as it moves, actuates the pointer.

The travel of the wand is effected by a feed screw exactly as a slide rest in a lathe is worked. On the rod supporting part of the weight of the carriage, with its switch-shifting rollers and pointer, are two collars, one at each end, which, when struck by the carriage, shift the belt so as to reverse the feed. Thus as long as the machinery operates, the pointer moves back and forth, from right to left, and reversing from left to right, along the line of the letters, the pantagraph attachment causing it to follow their outline exactly.

Behind the apparatus is a double switchboard, whose surface above and below is traversed by two




THE WESTERN ELECTRIC COMPANY'S EXHIBIT AT THE COLUMBIAN EXPOSITION—WRITING THE COMPANY'S NAME IN INCANDESCENT LAMPS.

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rollers. Spring jack pins, operating vertically, actuate a series of switches, one for each lamp, and turn the lamps on and off, one at a time. Two rollers, set one slightly in advance of the other and pressing against the upper and lower surface of the double switchboard, operate the spring jack pins. As the pointer moves to the right, the roller underneath, which is in the rear of the upper one, as referred to the direction of travel. presses up the spring jack pins, closes the contacts, and lights the lamps one by one. The pins are so placed with relation to the mechanism that as the pointer points to a lamp, it is lighted or extinguished. When the end of the letter O is reached, the belt-shifting mechanism comes into play, the rotation of the feed screw is reversed, and the carriage begins to come back. As it does this, it will be seen that the upper roller becomes the rear one. It presses down, one by one, the spring jack pins, opens the contacts, and extinguishes the lamps, each lamp being extinguished as the pointer points to it. The effect of this is that the pointer seems to write and obliterate the name in its travel, and as the pointer is visible to the audience, many wise conjectures are made as to its operation, induction and all sorts of mysterious powers being invoked to account for the mystery.

The larger figure of the cut shows the general disposition of the apparatus, while the arrangement of the spring jack pins pushed up and down by one or the other roller, throwing the lamps in and out of action, is shown in section in the smaller figure. The pins are arranged diagonally, so as to secure the pushing up or down of them in systematic progression.

### New Coal Vein in Mexico.

An extensive vein of coal has been discovered 13 leagues from Pachuca—the present terminus of the Mexican Central's Tula-Pachuca branch line. The coal is said to be of good quality, as shown by all the tests. The lack of cheap coal has always been one of the difficulties with which this company has had to contend. The opening up of extensive coal deposits anywhere near its line would therefore mean an important reduction in the operating cost of the property.

## THE WORLD'S COLUMBIAN EXPOSITION—THE COURT OF HONOR.

Within the last few months the Court of Honor has become a household word in millions of American homes. The glory of this unique creation is almost beyond description, and whether it be viewed in broad sunlight or at night under the glare of the electrical search lamps it never ceases to charm. The unity and harmoniousness of design exhibited by the buildings which fringe the Grand Basin testify to the rare skill of the architects, while the exquisite proportion of the various buildings makes the Court of Honor at once a triumph of elegance, symmetry and dignity.

The lower or lake end of the Court of Honor, illustrated herewith, which is terminated by Mr. C. B. Atwood's highly effective peristyle, probably affords the finest single view on the grounds. At the extreme right will be seen the end pavilion of the Agricultural building crowned by one of the horoscope groups. Beyond is the Casino, which is at right angles to the peristyle. Although the Casino fell into financial difficulties several times, still many can look back upon the Casino with pleasant memories of the hours spent in rest and refreshment under the hospitable roof. The Casino matches the Music Hall, which is at the other end of the peristyle. The peristyle is composed of forty-eight columns, twenty-four on either side. These columns are symbolical of the States and Territories. It is two hundred and thirty-four feet from each corner building to the grand Columbian Arch, which is surmounted by a quadriga representing "The Triumph of Columbus." The chariot is drawn by four mettlesome horses held in check by two women. Mounted heralds on each carry banners. In front of the arch on an isolated pedestal rises the heroic statue of the Republic, which is a masterpiece of the sculptor, Daniel Chester French.

The statue is sixty-five feet high and rests on a pedestal thirty-five feet in height. This bold creation, which is of a rugged and almost archaic type, worthily embodies the spirit of the New World. It is not altogether an independent work of art, but it is intended primarily as a piece of architectural sculpture, and is a complement of the surrounding buildings. At the left in our engraving, one corner of the Manufactures and Liberal Arts building will be noticed. Directly in front is one of the six Roman rostral pillars, whose tapered shafts are decorated with the representations of prows of captured galleys, and which are surmounted by statues of Neptune. It is a pity that this great dream of beauty could not be made permanent, but it will live for years in the minds of the millions of visitors who gazed upon its unparalleled magnificence, and in the photographs and engravings of illustrated histories.

THE WORLD'S COLUMBIAN EXPOSITION—THE COURT OF HONOR.

### Reptiles and Insects in the Philippine Islands.

The British consul at Manila, in his report on the Philippine Islands for last year, says: The reptiles and insects are various and abundant. Crocodiles are found in most of the deep rivers and uncultivated tracts. Enormous lizards, frogs, snakes, crabs, centipedes, huge spiders, ants, cockroaches, mosquitoes, beetles, etc., abound, more or less, everywhere. In the dry weather the trees around Manila are quite illuminated with fireflies. With insects in the house, however, one is less troubled than in most tropical countries, owing, it is said, to the predominance of the lizards and "chacons," which devour them, and which swarm sometimes on the ceilings by lamplight, and are quite harmless, while beneficial. There are huge pythons in the interior of the forests and various poisonous snakes in the fields and woods, some of which have a deadly bite, but people may pass their lives here without seeing a snake. Although a harmless species, the ratsnake frequently takes up his lodging under the roof, and only makes his presence known by the squeals of the rats which he seizes. The ants, white and red, and others, and the cockroaches and mosquitoes are more troublesome and destructive. Against the white ants precautions have to be taken by putting the legs of tables and sideboards into basins filled with water to prevent the insects climbing up and attacking articles of food. The destruction of wood by the white ants is something incredible—none but the hardest fibers withstand their ravages.

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## Correspondence.

### Meteor at Ogdensburg, N. Y.

*To the Editor of the Scientific American:*

Friday afternoon, October 20, in the vicinity of 5:20 o'clock, a brilliant meteor passed across the sky. I first noticed it nearly overhead, perhaps a trifle east of the meridian, and moving in southerly direction, or a little east of south, I should judge.

Although it was daylight, the meteor appeared larger and fully as bright as Jupiter does in the evening.

It had a pointed "tail" or train, apparently three or four times as long as its diameter, which looked like a flame, partly broken up by particles or sparks.

I send this, as perhaps you will hear of this traveler from other parts of the country. R.

Ogdensburg, N. Y., October 21, 1893.

### Home-made Storage Batteries.

*To the Editor of the Scientific American:*

An article appeared in the SCIENTIFIC AMERICAN of this year describing the manufacture of a storage battery that induced me to undertake the manufacture of one, and perhaps the many readers of your valuable paper would like to know how I succeeded.

I made two cells, each composed of eight 6 by 8 plates. I rolled my plates out of old tea lead melted into a bar. This lead is remarkably pure and soft, and easily worked. I roughened the plates and coated them with red lead made into a paste with water, and when they were dry I wrapped them with strips of muslin to hold red lead in place until it could be reduced in the "formation." I did not use sulphuric acid to mix red lead with, as it is not necessary and is bad for hands and clothes.

I used ordinary gravity glass jars for my cells and connected the cells in series, using a ten per cent solution of sulphuric acid (commercial) by measure. I charged the two cells at once by a current from six cells of gravity battery, arranged in series. Charged for eight hours and then discharged storage cells through ten ohms resistance. Then charged in opposite direction and discharged through resistance again; then kept charging and discharging in opposite directions for about ten days, when the cells were in good condition. I never have used more than six gravity cells to charge with and now keep charging current on all the time.

I use the cells to actuate my dental mouth lamp and plugger, and am making a motor to run my dental engine. The current from the two cells is strong enough to melt four inches of No. 20 iron wire and heats a platinum cautery wire white hot.

The manufacture and charging of a storage battery presents no difficulties, and its efficiency and power are remarkable, making it "the battery" par excellence.

Palmer, Neb., October 9, 1893. M.

### Instantaneous Photography.

BY CAPTAIN W. DE W. ABNEY, C.B., D.C.L., F.R.S.

If any point in an object is represented by a disk about $\frac{1}{100}$ of an inch in diameter, it is sharp to the eye. If, therefore, all movement of the object can in the image be confined to this amount, it will appear sharp. Now, with a hand camera, the focus of the lens is usually about 5½ inches—let us say 6 inches. At 50 feet off, therefore, an object may move through 1 inch and still appear sharp—that is, the motion during the time of exposure may be that amount. Say that the time of exposure is $\frac{1}{50}$ second, it is evident that the object at 50 feet off may move at the rate of 50 inches—say 4 feet—a second to fulfill the conditions. Now, a man may walk two steps of 2½ feet each in a second, and supposing he moves uniformly across the view, he would just move a *little* too quickly. Let him be 100 feet away, and he would be well within the limit laid down. If he were approaching or receding from the camera, of course the circumstances are changed, and the movement he makes in regard to the plate would be a slight up-and-down motion, and no movement would be perceived until he was quite close to the operator.

Let us take another example--an express train going about 40 miles an hour. During 1 second it moves about 60 feet. If it be desired to take this at a distance of 100 feet away while rushing across the field of view, it is not hard to see that a movement of 60 feet would require a rapidity of exposure of $\frac{1}{750}$ of a second. If it be taken at a distance of 750 feet, it would fulfill the required condition with an exposure of $\frac{1}{50}$ of a second. Express trains have been taken, but as a rule they are coming in a marked degree toward the operator, which immensely reduces the apparent motion. The motion of a breaking wave is small comparatively, and it will be found that for pictures of this description $\frac{1}{10}$ second is not too small an exposure with a lens such as is used with a hand camera. It must not be inferred that this is recommended, but only that such can be given without any great loss of sharpness. For street views the shortness of exposure should only be limited by the rapidity of the plate and the ratio of the aperture of the stop to focal length that can be secured. There are scarcely any shutters which expose more rapidly than the $\frac{1}{60}$ of a second, though, of course, there are some; but none that the writer has used is less than the $\frac{1}{100}$ of a second, and this is a very rapid rate. This only applies to shutters at the lens itself, and not to those next the plate. These last can be made to expose any part of a plate to almost any small fraction of a second by narrowing the slit which passes across it.

When instantaneous views are taken with lenses of longer focus, of course the limit of motion in an object is narrowed down proportionally; that is to say, with a lens of 12 inches focus the distances given in the examples must be increased proportionally, or doubled. This shows that in the quarter-plate picture it is more easy to secure sharpness than in, say, a whole-plate picture, since the focal length of the latter is, as a rule, longer than that of the former.

We may as well give a rule to find what motion is allowable. Divide the distance of the moving object, in feet, by the focal length of the lens in feet, and divide the product by 100. and it will give the result in inches. Thus if an object is 90 feet away from the camera, and the focal length of the lens is 12 inches (or 1 foot), the object may move $\frac{90}{1}$ by $\frac{1}{100}$, or $\frac{9}{10}$ inch during exposure. To ascertain if the shutter is sufficiently rapid to be within the limit, divide the allowable movement in feet by the rate of movement in feet per second. Thus, with the above, if the object were moving 10 feet a second, the speed of shutter required would be $\frac{\frac{9}{10} \times \frac{1}{12}}{10} = \frac{9}{1200}$ of a second, or about $\frac{1}{130}$ of a second—a time too small for most shutters. If sharpness be required with a shutter exposing $\frac{1}{50}$ of a second, the object should be taken at $\frac{30}{50} \times 90$ feet, 234 feet off, or in round numbers 80 yards off.

### English the World-Speech.

The advocates of English as the universal language have received a coadjutor from an unexpected quarter. There recently appeared in the *Preussische Jahrbuecher* an article from Dr. Schroer, advocating making the study of English obligatory in the schools. The reasons assigned for this are more interesting than the proposition itself. The need of a universal language has long been felt. The effort to introduce Volapuk was a recognition of this, but Dr. Schroer condemns any attempt to construct an artificial world-speech. A language, he says, without historical development, literature or linguistic relations will not be studied by any considerable number of people until it becomes universal, and hence it cannot become universal at all. This means that if we are to have a universal language it must be chosen from existing languages, and of course from the number of those that are widely diffused and spoken by great civilized nations.

Attempts to introduce artificial languages are not only hopeless, but they are unnecessary, for, says Dr. Schroer, there is already a universal language, and that is English. But in what sense is English a universal language? It is, says Dr. Schroer, one which, by its spread over the whole earth and by the ease with which it may be learned, has reached a position so far in advance of all others that neither natural nor artificial means can deprive it of its assured position as the future means of international intercourse. He, therefore, concludes that "the English language is the world-speech, and will, to all appearance, become more and more so every year."

This tribute to the English language is the more impressive because it emanates from one who has no bias in its favor from its being his mother tongue. The statements which he makes are fully borne out by facts. The language is spoken by the richest and most powerful commercial nation of Europe, in the greater part of North America, in the Sandwich Islands, India, South Africa and Australia. Since the beginning of the nineteenth century the number of English-speaking people has grown from 25,000,000 to 125,000,000. There is no prospect of any check to the progress of this triumphant tongue. It may be added that the study of English gives access to incomparably the richest literature in the world. Its claims to the primacy are so eminent and evident that even foreigners acknowledge them. It affords a practical and easy way to the attainment of the great desideratum of a universal language.—*Louisville Courier-Journal.*

### Oil Versus Coal.

Mr. Stone Burbury, of Cowes, Isle of Wight, owner of the yacht Venture, which was fitted with steam machinery, has had this removed and replaced with an oil engine, made by Messrs. Vosper & Co., of Portsmouth. The vessel would not before steam against the strong tides in the Solent, but does so now with ease; she could also only conveniently carry sufficient coal for six hours, but is now fitted for running forty-eight hours. The oil tank is also placed in a space which was before quite useless, therefore taking up no available room.—*Industries.*

### The Earth in Space.

There is a curious fascination in putting side by side the myth and science of astronomy. The old legends of the sun and moon, of earth and sky, of heaven and the stars, tell us of the selfsame objects whose place and size, whose weight and nature, astronomers are chronicling to-day. The difference is great indeed between the guesses of early times and the methods of modern science; nowhere else, perhaps, is the contrast seen so well between the infancy and the maturity of the mind of man, and no part of astronomy shows it so clearly as that which tells of the earth's place in the universe. To the Greeks, eight centuries before Christ, the earth was flat, surrounded by the sea, and covered by the canopy of sky, which is the floor of heaven, the abode of the Olympian gods. Greece was at the center of the earth, and Delphi at the central point of Greece. As to other worlds scattered through the sky depths, science has lately been learning much; something of their nature, their number, their distance is constantly being learned, while the way is being prepared for gaining some real insight into the relations of the stars among themselves, and for fixing our own position in regard to other suns and systems than our own.

We have to invent a new measure for talking of their distance, since, finding miles too small, we talk of "light years," which means the distance that a ray of light, traveling some hundred and eighty-six thousand miles a second, would traverse in a year. Before we get too used to talking of light years, it may be well to try to get a notion what a light year really is. It means a journey that would take an express more than eleven million years It means a velocity that the periphery of a gigantic flywheel one hundred miles in diameter could not keep up with, though it made five hundred revolutions in a second. It means a distance traversed in one second that sound will not pass over in ten days. And this is the unit for the quantities that modern astronomy deals with when treating of the distribution of stars in space. Sometimes one hears a cubic light year spoken of; that is, an imaginary cube with each side a light year long. It was long after men saw how to measure the distance of the stars before they succeeded so as to feel much confidence in the results obtained; but now the distances of a few stars are known with comparative accuracy and certainty, many measures having been made that probably come within twenty or thirty per cent of the truth.

The nearest star that has been found is Alpha Centauri, with a distance of 4⅓ light years. Probably next in order is a small star, numbered 21,185 in Lalande's catalogue. It is about 6½ light years off, while 61 Cygni, the most frequently measured of any star, is about 7 to 7½ light years off. But let us take our nearest neighbor and try to see something of the isolation of our solar system in space. Let us try to conceive of a sphere of which the sun is center, with a radius of 4·35 light years, so placing our nearest stellar neighbor on its circumference—translated into the more familiar unit, its diameter is over fifty billion miles and its cubic contents nearly three hundred and fifty cubic light years, or seventy thousand sextillions (7 with 40 ciphers) of cubic miles, for a cubic light year is rather more than two hundred sextillion cubic miles. Here is isolation indeed. The sun, with all its vastness, does not fill one two hundred-thousand-trillionth (2 with 23 ciphers) part of the sphere that has our nearest stellar neighbor on its surface. The gigantic volume of the sun in such a space is like an isolated shot containing but one-half of a cubic inch immersed in the whole water of the sea, while a little speck, less than the two-millionth of a cubic inch, suspended in the three hundred and seventy-three trillion gallons of the sea would represent the earth suspended in the sphere, the radius of which reaches only to the nearest star.

Did we set the pole star at the limits of our space sphere, the volume of the sphere would be three thousand times as great; and the sun must be thought of as occupying the six-thousandth part of an inch in the four hundred million cubic miles of sea. Were Vega, at a distance of ninety-six light years, on the boundary of our sphere, the space that reaches to our nearest neighbor must be increased ten thousand times in volume, and the earth becomes a difficult microscopic object in the vast abyss of sea. These are all stars whose distance has been measured with more or less accuracy; but there are other objects more remote that have defied all attempts to measure them—in literal fact, they are immeasurably remote distances. The figures given here to show the position of the earth in space are wholly paltry and inadequate compared with the (as yet) unknown reality. Much has been learned and the way prepared for yet greater advances. Man has dethroned himself from the chief position in the universe, has seen his world cease to be the center round which all else revolves; has recognized his abode as the tiniest imaginable speck in space; man—

> Who sounds with a tiny plummet, who scans with a purblind eye,
> The depths of that fathomless ocean, the wastes of that limitless sky

—yet has a longing to penetrate still farther through the star depths to win yet other secrets from the mysteries of space.—*Prof. Wm. Schooling, Knowledge.*

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### Willow Farming.

A new industry has been established in St. Louis county near the little town of Allenton, thirty-six miles west of the city of St. Louis, on the Missouri and Pacific and St. Louis and San Francisco railroads, which, if successful, will furnish employment to thousands of unemployed laborers. The enterprise is for the cultivation, on a large scale, of willows suitable for the manufacture of willow ware.

A description of the process through which the willow goes in its various stages of cultivation, harvesting and preparation for the factory, as given by the St. Louis *Globe-Democrat*, is interesting. The willow plant is obtained by cutting up live willow twigs twelve inches long. These are sharpened at one end and planted in rows by thrusting them into the ground to the depth of six or eight inches. As soon as the plants begin to sprout, the work of weeding and cultivating should begin and be kept up until the crop is laid by, the same as in the cultivation of corn. The canes ripen in the fall, when the frost strips them of the leaves and turns the bark a glossy brown color. When ripe, the willows are, under favorable circumstances, from ten to twelve feet in length. They are then cut and tied in bundles like rye, carted to the hothouses, where they are subjected to a sweating process, which softens and bleaches the bark, which is then easily peeled off by dragging them through a little machine made for the purpose. Another process is that of steaming the willows, which is much quicker, requiring only a few hours, while the former requires a month, but is not so desirable, as the willows are discolored to some extent and thus rendered less valuable for fine work.

The willow plants last about twelve years, after which they are grubbed up and the ground replanted. The plant does not attain its full growth until the second year, as the greatest part of its energy is spent the first year in making roots.

It is estimated that under the most unfavorable circumstances an acre of properly cultivated willows during the first three years will produce from 3,000 to 5,000 pounds of peeled willows, ready for market, the price of which is ten cents per pound, wholesale.

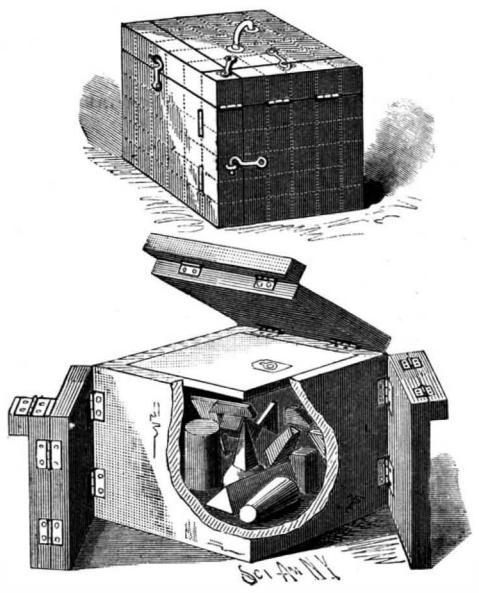
Taking the lowest estimate of the produce of one acre, 3,000 pounds, at the lowest market price, six cents, the marketable value of the product of one acre is $180. The cost of planting, including plants and labor, is $40 per acre. The highest estimated cost of cutting, hauling, steaming and peeling is about $50 per acre, making a total expense of $90 per acre, and leaving a profit of $90 per acre on the raw materials the first year.

### AMERICAN HISTORICAL EXPOSITION IN MADRID.

A recent number of *La Ilustracion Espanola y Americana* pictures these vases, called *huacos*, on account of having been found in the *huacas* or Peruvian sepulchers. They were found in the necropolis of Gran Chimu. The reader will discover the strange resemblance which exists between the productions of the precolumbian civilization in America and that of oriental Asia, a resemblance that is recognized by all learned men, but has never been explained.

### A GEOMETRICAL EDUCATIONAL APPLIANCE.

A device designed to facilitate the work of teachers of geometry, and which has been patented by Mr. Newton Z. Fulton, is represented in the accompanying illustration. It consists of a cubical shaped box of novel construction, and designed for use as a receptacle for the various models of plane and solid geometric forms, such as cylinders, cones, cubes, pyramids, globes, squares, triangles, ellipses, parallelograms, etc. The top of the box proper is made to fit within its sides, so as to be flush with their upper edges, and it has a flush or non-projecting handle or pull. On the outer walls of three sides of the box are hinged sections which when folded form a perfect cube of larger size than the box, and the sides have also other hinged sections which, by being movable, may be used to illustrate the principles of square and cube root by the segregate character of the aliquot parts of a square or cube. The hinged sections are provided with locking devices, whereby all the parts are connected together and not liable to be detached and lost, and an external handle affords convenient means of carrying the box.



FULTON'S CUBE BOXES FOR EDUCATIONAL PURPOSES.

Further information relative to this improvement may be obtained of Mr. D. J. Splane, Crested Butte, Col.

### How to Keep Cider Sweet.

Pure, sweet cider, that is arrested in the process of fermentation before it becomes acetic acid, or even alcohol, and with carbonic acid gas worked out, is one of the most delightful beverages. The following scientific method of treating cider will preserve its sweetness: When the saccharine matters by fermentation are being converted into alcohol, if a bent tube be inserted air tight into the bung, with the other end in a pail of water, to allow the carbonic acid gas evolved to pass off without admitting any air into the barrel, a beverage will be obtained that is fit nectar for the gods. A handy way is to fill your cask nearly up to the wooden faucet, when the cask is rolled so the bung is down. Get a common rubber tube and slip it over the end of the plug in the faucet, with the other end in the pail. Then turn the plug so the cider can have communication with the pail. After the water ceases to bubble, bottle or store away.

### How Mail Clerks Assist the Memory.

The railway postal clerks have a unique method, says a contemporary, for learning the routes on which post offices are located. Take, for example, the State of Pennsylvania, in which there are over 5,000 offices. The prospective mail distributer buys a quantity of blank cards--about the size of the ordinary visiting card—and on each of these he writes the name of an office. On the back of the card he writes the name of the route by which the office is served with its mail. Taking in hand a package of these cards—say from 50 to 100—he goes over them one after another studiously, looking at the back each time and getting the name and route clearly associated in his mind. The second time he goes through the pack he finds that he knows the half of the route by reading the name of the office. It is a dull student who upon going over a pack of cards a dozen times does not know them thoroughly. The method is so simple and such an aid to memorizing that it is adopted by all railway mail clerks. By it clerks have been known to memorize a State like Pennsylvania inside of two months.

On all large routes clerks work but half time, the other half being devoted to rest and study. The mail clerk at home, continually reminded of coming examinations, carries his cards wherever he goes, conning them over at every opportunity. One demonstrative clerk on the New York and Pittsburg R. P. O. is famed for having learned the State of Ohio in four days. As he shuffled over his cards he walked from garret to cellar, and *vice versa*, from dawn until the shades of twilight fell. On the fourth day he went to the examiner's office and separated Ohio without an error.

It is related that the wife of a postal clerk adopted the card method for increasing her vocabulary in French. On one side of the cards she wrote the French word and on the other the English equivalent to be learned. Another lady, hearing of this, used the same system successfully for learning mythology, placing the word "Mars," for instance, on one side of the card and "war" on the other. The method has so many advantages over the old and tedious way of learning from the pages of a book that it might be utilized with advantage by teachers in search of new methods of imparting instruction.

AMERICAN HISTORICAL EXPOSITION, MADRID—PERUVIAN VASES.

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## RECENTLY PATENTED INVENTIONS.

### Engineering.

STEAM PRESSURE GAGE.—Henry Rauser, Charles Wieber, and Alexis Sokoloff, Moscow, Russia. This gage consists of two communicating tubes open at their upper ends and partially filled with mercury or other suitable liquid, while a float-controlled valve of peculiar construction is adapted to regulate the admission of steam to one of the communicating tubes, whereby a pressure is exerted at intervals upon the surface of the liquid, causing the latter to rise in the other communicating tube and indicate the steam pressure on a properly graduated scale. The parts of the gage are designed to be subjected to slight pressure, while the gage will be very reliable and sensitive in operation.

HYDRAULIC STEERING APPARATUS.—Charles S. Irwin, St. Joseph, Mo. This apparatus comprises two single-acting pumps mounted on the boat, and having inlet and discharge pipes leading to common openings in opposite sides of the boat, one pump discharging on one side while the other is drawing in water from the opposite side, whereby the ejection as well as the suction will assist in the steering. The apparatus is designed to be of simple and durable construction and most effective in operation.

### Railway Appliances.

SAFETY FENDER FOR STREET CARS.—Henry S. Robins, Philadelphia, Pa. This device consists of a frame adapted for pivotal connection with the car, a yielding body portion having a spring connection with the frame, the forward portion of the body extending beyond the front edge of the frame, and the front edge of the body having a cushion, while a yielding partition extends across the body. The improvement is especially designed for cable and electric cars, and is capable of application to the front or the rear of the car. It is adapted to catch up and sustain without injury a person who may be standing in the track of a moving car, and when not in use may be folded up to occupy but little space.

SAFETY ATTACHMENT FOR STREET CARS.—Carl E. Baggesen, New York City. This is a fender, guard, or track cleaner, which may be folded beneath the end of the car when not in use. It consists of a swinging operating frame, swinging from the dashboard, in combination with an extensible and contractable carrier apron beneath the end of the car and connected with the frame. The carrier apron comprises a lazy-tong frame and frabric cover, with springs for operating the frame and a spring roller to wind the fabric. The carrier apron is projected forward when the operating frame is touched by a person or object on the track, one being thus caught and carried in front of the moving car.

RAILWAY SYSTEM.—Lina Beecher, Batavia, N. Y. This system comprises longitudinal sleepers supporting a single line of track rails, on which run vertical wheels journaled on the car, while flanged horizontal wheels run upon the faces of guard rails extending outwardly from the sleepers. The construction is designed to be very strong and inexpensive, permitting also of the use of rolling stock of low cost, while providing for the running of the cars with absolute safety.

FLUID PRESSURE BRAKE.—Alexander H. Moyes, Ogden, Utah. This invention relates to the Westinghouse type of air brakes, providing a quick and positive action for applying and releasing the brakes. The improvement comprises an auxiliary air cylinder and air reservoir, through the ends of which extends a brake rod having pistons on its ends, a pipe connecting the train pipe with the outer end of the cylinder, with various other novel features. The arrangement is such that the auxiliary reservoir is always charged with air pressure to actuate the brake mechanism, to apply the brakes quickly as soon as air is released from the train pipe.

SAFETY HINGE SWITCH FROG.—Joseph E. Dunlevy (care of Dr. J. M. Reynolds), Memphis, Ind. The frog switch devices proper, according to this invention, comprise two base sections, one at each side of the main rail, one being a long and the other a short section, the upper faces of which are in different horizontal planes. The construction is such that the main track is at all times left free from joints or splices at the frog, permitting trains to pass at as high a rate of speed and with as much safety as at any other point on the line. The improvement also facilitates the siding of trains in a safer and simpler manner than is now customary.

### Electrical.

ELECTRODE.—Farnham M. Lyte, 60 Tinborough Road, London, England. This invention relates to the carbon electrodes used in the electrolytic decomposition of metallic chlorides or other metallic haloids in a fused condition. Combined with a hollow carbon electrode closed at the bottom and open at the top is a core of metal or alloy which is fusible at the same or a lower temperature than the salt to be decomposed, so that the core will melt, and in the fluid state make intimate electrical contact with the carbon of the electrode, but will exert no bursting strain thereon. The terminal of the electrode is put in electrical communication with the fusible core by a conducting rod dipping into the fusible core, but entirely free from the carbon. By this means the thickness of the carbon to be traversed may be so much reduced, and the resistance so diminished, that the current will easily traverse the carbon throughout its whole area, thereby enabling electrodes of considerable length to be used.

CONNECTOR.—Charles Bell, Stroudsburg, Pa. This is a device for mechanically and electrically connecting the ends of electric light and telegraph wires, etc. It consists of two longitudinally grooved pieces connected by a clamping screw, one of the pieces having holes coincident with the groove for receiving the angled ends of the wires, and the other piece having a notch for the release of such ends.

### Mechanical.

PLANE GUIDE.—John McKnight, Fredericton, Canada. This device has jaws by which it may be readily attached to a plane of any size, and one of the jaws is an adjustable arm carrying a longitudinally and laterally adjustable guide block, by which the plane may be made to edge a board perfectly true and square, or plane the edge on any desired bevel. The device is very simple and cheap, and its parts may be cast.

SANDPAPER WHEEL OR ROLLER.—Frederick H. Stubbe, New York City. This invention comprises a cylindrical shell with a longitudinal slot, and two clamping bars in the heads of the shell to clamp the sides of the paper, the bars having at their ends beveled heads to be engaged by nuts screwing at the end of one of the bars to move the latter toward each other for clamping the paper. The improvement permits of conveniently spacing the sandpaper in position and drawing it tight around the shell, while also allowing of its ready removal when worn out.

### Miscellaneous.

NEGATIVE AND SCREEN HOLDER.—James Scouler, San Francisco, Cal. A simple yet effective invention for holding and adjusting a screen plate used in making half-tone photo. negatives for printing purposes, with reference to the sensitive plate. The usual rabbeted frame for holding the sensitive plate is provided with special wires and pins for preventing the glass sensitive plate from coming in contact with the wood, while on the opposite side or face at each corner are pivoted spring buttons, which, after the screen plate has been placed in position in front of the sensitive plate, are rotated inward, and hold the screen securely at each of its four corners. The screen can be readily adjusted at different distances from the plate by means of bars or rods inserted in special recesses provided therefor. The quick adjustment of the screen and the facility with which it is held in position are the chief merits of the invention.

AIR VALVE.—Alfred T. Neilson, Jersey City, N. J. This is a device especially adapted for use on pneumatic bicycle tires. It has a valve casing to screw on the nipple, the casing having conical chambers in opposite ends connected by a bore, a conical valve being held in the inner chamber, and having ports in its base, while there is a conical valve in the outer chamber and a screw cap to close the outer end of the casing. By this improvement air may be easily pumped into the tire, a temporary check preventing any escape while the pump is being disconnected, and when finally adjusted the valve is absolutely air tight.

STREET SWEEPER.—Charles Gurney, Brooklyn, N. Y. This is a machine which is adjustable in its working parts, convenient to control, and designed to be especially reliable and effective in service. By its forward movement over a roadbed, when the brushes are in contact therewith and adjusted to revolve, the dirt is first swept from the gutter toward the center of the road, and the windrow thus produced is swept upon elevator buckets and discharged into a car held on the machine, the car being carried upon the sweeper to some point for removal to be unloaded or dumped.

STAMP VENDING MACHINE.—William H. Kaltenbeck, Middlesborough, Ky. This is a machine especially designed to sell postage stamps. It is not likely to get out of repair, and upon dropping in its slot certain coins delivers a quantity of postage stamps of equal value, the machine being also arranged to make and return change when necessary. The machine has a holder for a ribbon of stamps, in connection with a coin-controlled feed mechanism for forcing the stamps through a delivery slot, a number of coin chutes delivering their coin on the controlling mechanism of the feed, and various other novel features.

REPEATING AIR GUN.—Elmer E. Bailey, Philadelphia, Pa. This is an improvement upon guns whose magazine tube is traversed by a small firing tube or barrel through which large shot or small bullets are projected by an air jet, the air being compressed in a chamber by a reciprocating spring-actuated piston. The invention covers a novel mechanism adapting the air compression cylinder to reciprocate, to alternately open and close the passage into which the shot are delivered from the magazine, and to force the shot into the firing tube preliminary to their ejection by the air blast. The improvement is designed to lessen the cost and improve the efficiency of this class of guns.

FACING BUILDINGS.—James W. Graham, Old Fort, N. C. For the facing of the walls of buildings with ashlar tiling, terra cotta, etc., this invention provides simple and inexpensive means of securing thin plates or tiles in place, consisting of a metal-holding strip having a pointer flange and a base flange, the latter having a number of slots to receive fastening nails or screws.

STOVE.—Albert W. Alger, Kansas City, Mo. This is a stove which is cheap to make, and designed to be very economical of fuel, while affording greatly increased heat radiation. It is preferably cylindrical in shape, with a fire box at one end and a smoke exit at the other, its body being traversed by longitudinal and transverse heat-radiating flues, with end and side discharging apertures. It is adapted for use with any kind of fuel, and a gasoline or coal oil burner may be set on the grate.

LABELING MACHINE.—William H. Leister, Westminster, Md. A label holder or box is, according to this invention, arranged at the foot of an inclined bed on which is a paste pad, an inclined or curved depressible label-holding plate extending across the foot of the label box, while there is a curved rolling table behind the label holder. A very simple device is thus provided for nicely labeling cans, which are rolled over the paste pad to be coated with paste, and then over a bunch of labels, the upper one of which adheres to the can.

ADJUSTABLE WINDOW SEAT.—William Kruppenbacher, Yonkers, N. Y. This is an improvement in devices to facilitate the cleaning of windows on the outside, affording a seat adapted for ready attachment to or removal from a window casement, and having considerable range of lateral adjustment. The device has a base board with a guard railing, and laterally adjustable wings which slide in boxes and engage the window casement, flexible devices retaining the wings at different degrees of projection.

WATERPROOF SUIT.—Otte Van Oostrum, Portland, Oregon. This suit is mainly made of waterproof goods, and consists of a jacket and trousers joined at the waistband in a waterproof manner, both garments when on having the appearance of the usual articles of their class. The sleeves have elastic inner cuffs, and the shoes are permanently secured to the trousers legs, or made separate with an elastic waterproof connection.

DUMPING WAGON.—George W Harrington, Pullman, Ill. An endless apron, journaled on rollers at the ends, forms the bottom of the wagon body, and from a hook on the bottom portion of the apron a chain extends to the whiffletree, so that when the whiffletree is detached from the vehicle and the horse moves forward, the top portion of the apron, forming the bottom of the wagon body, will be moved backward, and the load will be dumped at the rear, where the apron passes around the rear roller.

DRIVING REIN AND TAIL HOLDER.—Burdine Blake, London, Ohio. This is an attachment, preferably made of a single piece of stout leather, and forming part of the harness, constituting a rein holder and preventing the horse from getting his tail over the reins. It is saddle-shaped, and has a front tongue connecting with the back strap, and side tongues for the breech strap, an aperture through which the reins are passed, and a curved guard surface covering the tail.

APPLIANCE FOR SPINAL COMPLAINTS.—Philo B. Shelden, Erie, Pa. This is mainly an adjustable brace or corset, with steel-stayed back pad, adjustable crutches also having combined with them steel body bands or rests, while an abdominal pad or belt is held in place by suspension attachments, and bands or webs are adapted to pass around the legs half way between the knees and hip joints. The improvement is designed to facilitate the remedying of deformities and curing of affections of the spine, relieving the spine of the weight of the upper portion of the body, and avoiding the use of stiff jackets and the objections found in other forms of spinal corsets.

TEMPORARY BINDER.—Charles T. Rosenthal, Batesville, Ark. The covers of the book are connected by the usual concaved back, adjacent to which this binding device is located, consisting of rods sliding in bearings attached to opposite sides of the back section, while straps are arranged in pairs, so that one strap of each pair is rigidly attached to the bearings and the other strap of each pair is attached to the rods and actuated thereby. By this means any number of leaves may be introduced and bound between the covers or readily removed therefrom without disturbing the adjacent leaves.

RENOVATOR.—Charles Karlson, Red Bank, N. J. This is a simple and convenient device to facilitate the quick and thorough removal of dust from upholstered furniture and carpets on floors. It comprises a receiving box having an open lower end engaging with the fibrous material to be cleaned, an inlet valve at the lower side within the box, an outlet valve, and a bellows. It is designed to remove dust, previously loosened by beating, by exhaustion of the air where it is applied, thus drawing the dust from the material to be cleansed and discharging it into a receptacle or at a point exterior to the room.

BUST SUPPORTER.—Ludwig Lerdry, New York City. This is a waist-like garment, preferably made of a woven or knit fabric, and having integral front pockets to fit the form, shoulder straps, an elastic waist band and straps, and a fastening device.

CURLING IRON.—William M. Cleeland, Great Falls, Montana. This is a device permitting the hair to be wrapped around the tube before the heat is applied, thereby avoiding danger of burning. It has a long, tapering, conical tube, at one end of which are pivoted two wire arms and a tongue adapted to lie between them, the wire arms clasping the hair as it is wound around the tube and tongue, when a tapering heating iron with non-conducting handle is inserted in the tube to heat the latter to the desired temperature.

POTATO SLICER.—Henry B. O'Connell, New York City. This is a simple device designed especially to facilitate the cutting of peeled potatoes into such shapes as used for making "French fried potatoes." It consists of a table in which are set longitudinal and transverse knife blades, over which operates a plunger head reciprocated by a handle lever, the head having on its under side blocks arranged to pass into the openings formed by the intersecting sets of knife blades.

WIRE HANGER.—William Trewhella, Newbury, Victoria. A single piece of wire is bent at one end to form a hook adapted to be hung on a chimney crane, and at its other end it is bent to form a hook completed at its point by a right angular bend, for engagement with the handle of a saucepan or other article, to facilitate holding the saucepan over a fire any required height.

TOY OR ORNAMENT.—George H. Newton, Monson, Mass. This is a device in the shape of a bird, the body having at its lower end a pin turning in a support, as in the upper end of a flagstaff, and the body having a cross spindle carrying wings curved to form propeller blades. The body is made as flat as possible to hold the wings to the wind, whereby they may be revolved. As a toy, children may rotate the body and wings by moving the device back and forth.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

## NEW BOOKS AND PUBLICATIONS.

HOW TO THINK IN GERMAN. By Charles F. Kroeh, A.M., Professor of Languages in the Stevens Institute of Technology. Hoboken, N. J.: Published by the author.

The fundamental idea is the same as in "How to Think in French" by the same author. The learner associates with his own actions day after day, as he performs them, the correct German sentences that describe them. No English comes between him and what he wishes to say in German. Then he is taught to vary the sentences according to the genius of the language. They serve as patterns or formulas of speech in which he gradually substitutes the rest of his vocabulary. Finally he connects sentences together in all possible ways. All the grammatical difficulties of German (the declensions, the order of words, the command of verb form, indirect discourse, etc.) are taught practically in an entirely original way, by which the learner gradually emancipates himself from his dependence on English for the expression of his thoughts. Especial attention is called to the chapter on reading for a speaking vocabulary and on learning short stories. As a practical book to aid in quickly acquiring the power of correct and fluent speaking of the German language, this work has no equal. Every learner should procure it. Professor Kroeh is one of the ablest of instructors and this book is the concrete result of many years of active experience in his profession.

UNIVERSAL BIMETALLISM AND AN INTERNATIONAL MONETARY CLEARING HOUSE, TOGETHER WITH A RECORD OF THE WORLD'S MONEY, STATISTICS OF GOLD AND SILVER, ETC. By Richard P. Rothwell. New York: The Scientific Publishing Company. 1893. Pp. 53. Price 75 cents.

Coming from the editor of the leading mining journal of the United States, the above work is a plea for the continuation of silver coinage. The author believes that the problem with which the United States is now confronted could be solved by an international system of bimetallism. An immense amount of labor is indicated by the statistics and data contained in the text and tables. One interesting feature is a chronology of the gold and silver industry for the last 450 years. It is not, of course, quite up to date, owing to recent events in British India and in this country, and quite possibly within the next few months may fail in chronicling some very important changes.

BRITISH LOCOMOTIVES, THEIR HISTORY, CONSTRUCTION, AND MODERN DEVELOPMENT. By C. J. Bowen Cooke. With numerous illustrations from sketches and diagrams by C. E. Jones and R. A. McLellan. London: Whittaker & Co. 1893. Pp. xvi, 381. Price $2.

The American railroad engineer has become fully awakened to the value of several details of English locomotive practice. From the work under review numerous illustrations, in addition to the text, excellently present the field described. It is written, of course, entirely from the English standpoint. The chapters on the running of engines, touching on the duties of the crews, lubrication, packing and other details, giving the English practice, will be of special interest to our engineers.

MISSOURI STATE MEDICAL DIRECTORY. Containing a carefully prepared list of physicians, dentists, and druggists, together with colleges, hospitals, medical associations and societies throughout the State. St. Louis and Chicago: The Medical Fortnightly Press. 1893. Pp. 119.

ESTIMATE BLANKS FOR STEAM AND HOT WATER FITTERS. Adapted more particularly for dwellings and apartment houses, small stores, and general low pressure work by either steam or hot water. New York City: Nason Manufacturing Co. Pp. 100. Price $1.50.

This excellent series of blanks, dedicated to the steam and hot water warming fraternity, will be found very useful for contractors. It consists of a series of two pages of a repeated blank, containing the titles of the different measurements to be taken and noted and other particulars referring to the heating of dwellings. It is, without question, something which, for those engaged in such a business on an extensive scale, would not only conduce to the saving of a great deal of clerical labor but would also tend greatly to the accuracy of the labor with which such work must be done.

PALLISER'S COMMON SENSE SCHOOL ARCHITECTURE, ILLUSTRATING THE PRACTICAL AND ECONOMICAL WARMING AND VENTILATION AND THE CORRECT PLANNING, ARRANGEMENT AND SANITARY CONSTRUCTION OF SCHOOL BUILDINGS FOR AMERICAN CITIES, TOWNS AND VILLAGES. By Palliser, Palliser & Co., architects. New York: J. S. Ogilvie. Pp. 110. Price $1.

In this series of illustrations of school houses, for the book is little more than that, we find indicated a strongly accentuated departure from the old system of plain and unattractive school buildings. The variety of structure exhibited in this volume is quite striking, and for many of the plans quite elaborate specifications are given. The elevations and perspectives are in many cases very artistic. There is a certain amount of text on general topics in the line of the work, other than specifications.

DAS ATELIER UND LABORATORIUM DES PHOTOGRAPHEN. By Dr. Josef Maria Eder, Director of the Imperial Institute for Photography, etc. Halle a. S., Germany: Wilhelm Knapp. 1893. 325 engravings. Pp. 172.

The book forms a supplementary volume to the Handbuch der Photographie by the same author, and treats in

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a very exhaustive manner on the special construction and arrangement of photographers' studios, their dark rooms, washing arrangements, etc., and other furnishings and utensils necessary for proper working. Portable dark rooms, such as tents, wagons, developing hoods, etc., are also described and illustrated. A chapter on printing, and finishing concludes the interesting book.

PHOTOGRAPHISCHES TASCHEN LEXIKON. By Dr. Julius Schnauss. Halle a. S., Germany: Wilhelm Knapp. 1893. Pp. 157.

This valuable pocket dictionary gives the technical terms used in photography in German, English, French, and Latin. The explanation of the terms is in German, is concise and correct. The vocabularium contains the terms in English-German, French-German, and Latin-German.

THE BOOK OF THE FAIR. Chicago and San Francisco: Bancroft & Co.

Those who desire to crystallize their recollections of the Columbian Exposition will be interested in this publication, which, from an artistic point of view, is of a high order. The views are not confined to the beautiful exteriors of the buildings, nor to the classical splendor of the lagoons, but include the many art treasures, both sculptures and frescoes, and also many of the individual exhibits. The views are principally photographic "half tones" and the letterpress is bold and clean. This work is published in quarto folios, there being in all 25 parts, at $1 each. Messrs. Rhule, Thomas & Co., 24 Park Place, New York City, are agents for this section.

AN ELEMENTARY TREATISE ON THEORETICAL MECHANICS. By Alexander Ziwet. New York: Macmillan & Co. 1893. 8vo. cloth. Pp. 181, 76 diagrams. Price $2.25.

The present work owes its existence mainly to the difficulty of finding a good modern text book suited to the requirements of the American student. The author is assistant professor of mathematics in the University of Michigan, and his aim has been to produce a text book for use after the student has acquired a knowledge of the elements of the higher mathematics; so no attempt is made to treat the subject other than mathematically.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

## SCIENTIFIC AMERICAN BUILDING EDITION.

**NOVEMBER, 1893.—(No. 97.)**

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2. Plate in colors showing the residence of Clarence M. Burch, Esq., at Philadelphia, Pa. Two perspective views and floor plans. A very attractive design. Messrs. Moses & King, architects, Philadelphia.
3. A dwelling erected at Joliet, Ill. Perspective views and floor plans. An excellent design. Cost $6,000 complete. Mr. J. C. Weece, architect, Joliet, Ill.
4. A suburban cottage erected at Glenbrook, Conn., at a cost of $3,500 complete. Floor plans, perspective view, etc. Mr. E. H. Waterbury, Stamford, Conn., architect. An excellent design.
5. Engravings and floor plans of a suburban residence erected for Mr. George H. Barton, at Hartford, Conn. Messrs. Hapgood & Hapgood, architects, Hartford, Conn. A very attractive design.
6. Very excellent design for a two-family house, erected at Bridgeport, Conn., at a cost of $4,500. Floor plans and perspective elevation. Mr. A. H. Beers, architect, Bridgeport, Conn.
7. St. Peter's Chapel at Springfield, Mass. Perspective and ground plan. Cost $7,100 complete. Mr. W. P. Wentworth, architect, Boston, Mass.
8. Engraving showing some city dwellings of modern design at Washington Heights, New York City. Plans and perspective views. Mr. W. E. Mowbray, architect, New York.
9. Residence of Mr. C. T. Hemstead at Glenbrook, Conn. Plans and perspective. An excellent design.
10. Moving of the Normandy apartment building at Chicago. Supposed to be the largest building ever moved and turned around on rollers. Numerous illustrations.
11. The World's Columbian Exposition. A general view.
12. Sketches at the World's Columbian Exposition.
13. Miscellaneous Contents: Causes of fire in dwellings.—An improved brace, illustrated.—Steel ceilings, illustrated.—A large day's sawing.—The new mode of constructing foundations.—Sheathing quilt, illustrated.—A cap for the obelisk.—Interior woodwork for buildings, illustrated.—Electrical injuries to gas and water pipes.—An improved scraper, illustrated.—Linseed oil for paint and polish.—Improved circular sawing machine, illustrated.


The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

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## Business and Personal.

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Order pattern letters & figures from the largest variety. H. W. Knight & Son, Seneca Falls, N.Y.. drawer 1115.

Stow flexible shaft. Invented and manufactured by Stow Mfg. Co., Binghamton, N. Y. See adv., page 222.

"C. S." metal polish. Indianapolis. Samples free.

Improved iron planers. W. A. Wilson, Rochester, N.Y.

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Razorine will sharpen your razor, or money refunded. 15 cents mailed. Razorine Co., 2 W. 14th Street, N. Y.

Estimates furnished for moving, raising, or shoring buildings. W. K. Clynes, Jersey City, N. J. Estab. 1853.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps. Capacity, 100 to 40,000 gals. per minute. All sizes in stock. Irvin Van Wie, Syracuse, N.Y.

For Sale—Patent household article. Cost to make less than 10 cents, and will sell for $1. J. F. Ervin, Fort Wayne, Ind.

Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

P. B. Shelden's improved mechanical appliances for spinal complaints is the best support ever introduced for invalids and persons that become weary by long sitting or standing without exercise, as well as for curvatures, stoop shoulders, etc. Patent issued Oct. 24, 1893. For sale. See page 316. P. B. Shelden, 1013 Chestnut St., Erie, Pa.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

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## Notes & Queries

HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(5461) B. A. C. writes: Encircling the sun this morning is one of those rings which I believe are called sun dogs. I believe they are said to foretell a storm, and in fact I have noticed that storms develop after one of these dogs appears. Will you tell me why this is so, and why the larger the ring the greater the storm? A. Halos, coronas, and parhelia with sun dogs, are the various designations for the different phenomena of the sun's light as refracted and reflected by the vesicles of water as fog or incipient cloud formation, or by the crystals of snow in its various forms as existing in the upper air. The various forms of these phenomena are supposed to be due to the varying forms of snow crystals as they commence forming and before clouds are manifest to the eye, but are generally followed immediately by cirrous clouds indicating an approaching storm. The extent and complexity of the phenomena may in a measure indicate the intensity of the coming storm, but like other meteorological indications, little reliance can be placed upon such indications.

(5462) W. R. S. writes: I would like to know the best and most durable cement that will stick to iron or steel? A. Much depends upon the use that the cement is required for and the condition of the surface of iron or steel. There are but few compositions that will hold to polished iron or steel surfaces. Roughness of surface, especially if it has been treated with acid, will give almost any cement a sticking property. Good glue with a few drops of glycerine to a pint and a tablespoon of extract of oak bark applied quickly is an excellent cement for fastening leather and wood to iron. For many purposes the thick varnishes mixed with metallic oxides to a thin putty make good cements for iron. See "Cyclopedia of Receipts" for more than 600 receipts for various kinds of cement and for all purposes, $5 by mail.

(5463) L. H. D. asks: What thickness should the ice be to move a frame cottage 23×27, three rooms on lower floor, two rooms upstairs, thoroughly built, braced, plastered and finished, shingle roof, chimney 28 inches by 32 inches, across a lake about one-third of a mile wide? What is the cheapest way and the best to prevent a 2 inch plank, Michigan pine tank 6 feet high 9 feet diameter, from freezing in a barn 35 x 75 where only three cows are kept? The tank is under the roof, on the east end of it, supplied by a windmill. Would simply banking up hay around and underneath be sufficient? What is the best packing to use on a windmill force pump? Is Selden piston rod packing good for that purpose? Ordinary cotton packing requires too much attention. A. The ice should be not less than 12 inches thick, with means provided for keeping the house moving on a large base or bearing upon the ice. Inclose the tank sides and bottom in a board box with 1 foot of space all around and pack the space with hay. Make a tight cover for the top and batten all openings at the top of the barn, near the tank, to prevent too much circulation of air around the tank in cold windy weather. Any linen packing soaked with clear tallow makes a good water packing.

(5464) M. T. W. asks what the difference is between a square foot and a foot square. A. There is no difference in the superficial area of the two expressions. A square foot may be of any form of surface, provided it contains an area of one square foot. A foot square is of the same area, but must be one foot in length on each of its four sides, or in other words, a square foot is a unit of area, while a foot square is a unit of fixed dimensions.

(5465) O. B. asks the best oil to use in a trainman's lamp, as it requires to stand unlimited shaking without going out, and not form a crust on the wick, or as little as possible, and also an oil that will not freeze. A. The best oil will not fill all the requirements of our correspondent, but a very good oil for lamps may be made from pure sweet lard oil mixed with 10 per cent of astral oil.

(5466) A. P. J. says: I have some squashes in fine condition and would like to preserve them as long as possible. I am told to heat them for a few seconds in an oven at a high temperature, also that varnishing serves to keep them longer. Please state if either treatment is a benefit and the best way to preserve them. A. Varnish might flavor the squashes unfavorably unless melted paraffine is used. Whitewashing has been used with good results.

(5467) W. R. J. asks how phosphide of tin is made. How is the phosphorus kept in the tin while cooling down? A. The following process is given: Precipitate tin by placing a bar of zinc in a solution of tin chloride. Remove the metallic tin and place it in a crucible while still moist, along with some sticks of phosphorus. Expose to a gentle heat until flames no longer appear. The phosphide of tin remains as a crystalline mass at the bottom of the crucible. All operations connected with phosphorus are very dangerous.

(5468) L. C. S. writes: I have two barrels of strong red wine vinegar; how can I change the color and make it a white or light vinegar without injuring it? A. Filtering through bone black may effect your purpose. There is danger of impairing its flavor. Try on a small sample.

(5469) W. H. B. asks: Can I magnetize short steel bars, suitable for telephones, at power generator of electric street car or electric light plants? If so, how is it done? A. Simply touch one end to a pole of the dynamo when in action.

(5470) C. H. McD. asks if white cotton cloth will in any way be injurious to the plates of a storage battery, or would it be better to remove same after forming, or still better not to use it at all? A. It is better to remove the cloth after forming. It may tend to clog up the cell, and will in any case soon decay.

(5471) M. B. says: Can you give me a receipt for bluing gun barrels other than heating and pouring oil on? Please tell how to clean leather belts that have become soiled by handling? How can I take rust from a polished steel surface without scratching it? A. The bluing of gun barrels, with many useful points in regard to guns, are described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 830, article "Gun Wrinkles." Leather belts may be cleaned with Castile soap and water or benzine, dried and softened by working in the hands. Rust on polished steel should be polished off with wet rouge on a buff stick; finish with dry rouge.

(5472) A. M. B. asks for the proper size of wire to use in winding an Edison dynamo about one-half size of the one in SCIENTIFIC AMERICAN SUPPLEMENT, No. 844. A. The size of wire depends on the voltage and amperage desired. You might use wire of one-half the sectional area of that specified.

(5473) J. G. asks the origin of the center board or sliding keel as used on American yachts. Is it an American idea or simply an adoption? A. The center board was derived from the old Dutch side board or lee board. The center board is an American invention, as far as our record goes.

(5474) T. S H. says: It may not be generally known that glycerine is the best for the oil stone for sharpening edge tools. It does not dry into the stone as do other oils and harden the surface. The stone is easily cleaned with water.

(5475) A. J. H. asks: 1. I have an 8 light 16 candle power dynamo, shunt wound, which I wish to use as a motor for running a 9 inch by 25 inch foot lathe, and what I wish to know is if it is practicable to cut out part of the wire in field magnets and armature so that it will not require so much current to operate it, as I shall not need quite ¼ horse power? A. We advise you not to alter your dynamo if its winding suits the potential of your circuit. An excess of size is a good error. 2. What would be the best form of primary battery to use, how large a one should I require, and would it cost much to run it say 2 hours a day? A. We do not advise primary batteries. A simple bichromate plunge battery, such as described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, is about the best. It will be rather expensive and troublesome to run. 3. I wish to make a small vapor engine of about ¼ horse power, and should be pleased if you would tell me if there has ever been a paper published in SCIENTIFIC AMERICAN SUPPLEMENT on how to make one. What I wish to know is how to make an electrical coil to produce the necessary spark to explode the charge, how it should be connected, and what should be the proper quantity of air and vapor for a charge. A. For gas engines we refer you to the following books: "Clerk on the Gas Engine," $2; Robinson's "Gas and Petroleum Engines," $5.50, which we can supply by mail. A simple spark coil of five pounds No. 18 or 20 wire, wound on a core of soft iron wire and actuated by 4 or 5 cells, is enough. It is very difficult to determine the design for a new engine.

(5476) W. J. M. asks: 1. How to tell the positive or negative pole of a storage battery by looking at it. A. The positive or oxidized plates have a reddish brown color, the negative or reduced plates have a gray color. The latter correspond to the zinc plates of a primary battery. 2. How often does the solution require to be renewed? A. No time can be stated. Water has to be added from time to time to keep the plates covered, and sometimes, if the specific gravity falls, sulphuric acid of 1.140 (about) specific gravity is used instead of water as above. 3. What precautions are necessary when plates become buckled? A. Introduce glass strips or rods to prevent the plates from touching. You may be able to straighten them by hand. 4. What is the life of storage batteries when carefully handled? A. No limit can be assigned? They may last many years. 5. Is there a mechanical device to indicate when a battery is sufficiently charged? A. The hydrometer. They should be charged until gas is evolved. 6. How should four such cells be coupled up—all positive poles together or *vice versa*? A. The positive plate of one to the negative of the next, and so all through as a rule. 7. How to detect sulphating? A. By the color of the positive plates. These show white patches if sulphated. 8. In setting up with fresh solution, should the solution be allowed to cool before the charging current is put on? A. Yes. 9. How often should a battery of four cells be charged when used heavily 10 hours a week (on an electric organ), and how long should the charging current be left on? A. Do not let its E. M. F. fall below 2 volts per cell. Charge until the solution bubbles. 10. Can you inform me how to solder aluminum, also what flux is used? A. For working aluminum see our SUPPLEMENT, No. 602, also SCIENTIFIC AMERICAN, vol. 65, No. 2, and vol. 62, No. 26. 11. What transparent solution is used in tube pole indicators? A. Use potassium iodide. 12. What metal are the thin springs in the Blake transmitter made of? A. Watch spring. 13. How are the faces of the carbon buttons hardened? A. If French carbon of fine quality is used, hardening is unnecessary. To harden, soak in a hot solution of ammonium carbonate, dry, and recarbonize. Repeat several times. This formula is given by one of our large electrical companies. You may also boil in sirup, wash the surface off, and recarbonize under charcoal dust in a tightly closed vessel. 14. How many volts are in an ampere? A. None; they are separate and distinct units. 15. What is meant by ampere turns? Does it mean one turn of a certain size of wire? A. The product of amperes of current by the net number of convolutions in one direction in the conductor. We recommend and can supply you with the following books relating especially, the subject you refer to: Reynier's "Voltaic Accumulator," price $3; Salomon's "Electric Light Installations and Management of Accumulator," price $2; Niblett's "Secondary Batteries," price $1.50.

Answer to E. J. P., No. 5407, contained an error as to distance. The answer should have been 11·17 feet.


**TO INVENTORS.**

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.


## INDEX OF INVENTIONS

**For which Letters Patent of the United States were Granted**

**October 31, 1893,**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]


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Adding machine, W. S. Gubelmann ..... 507,810
Air purifier, J. S. Dodge ..... 507,675
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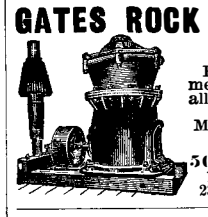

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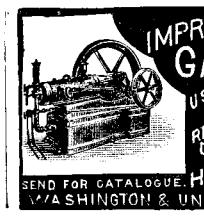

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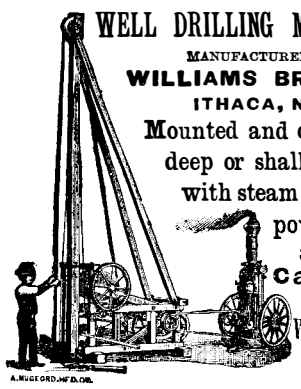

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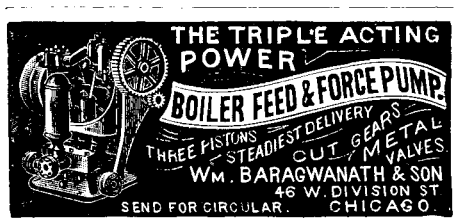

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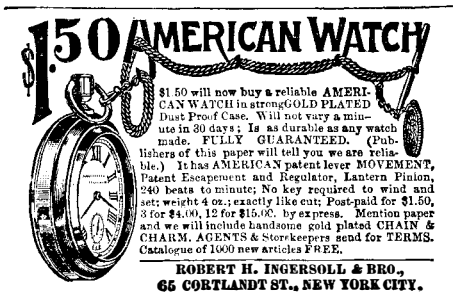

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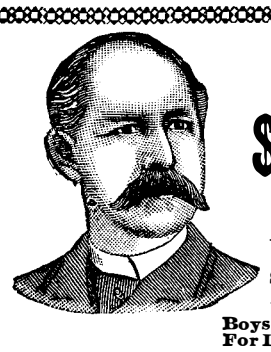

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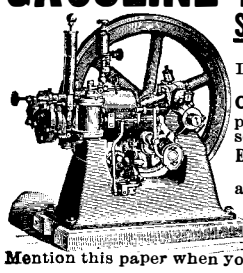

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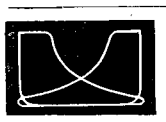

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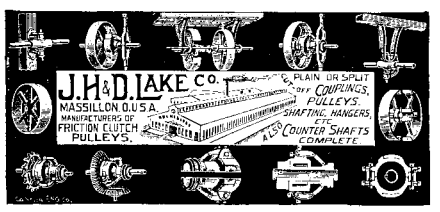

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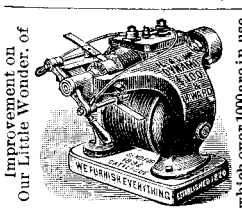

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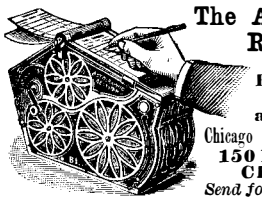

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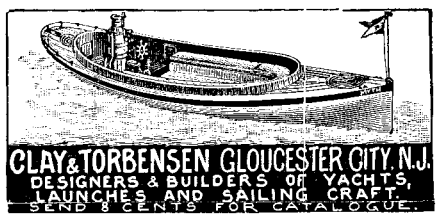

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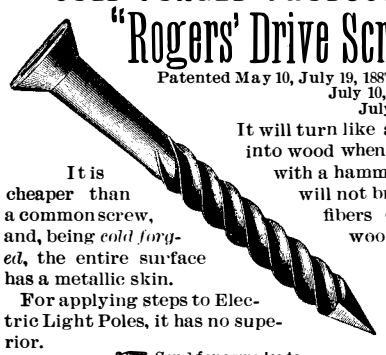

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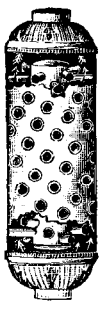

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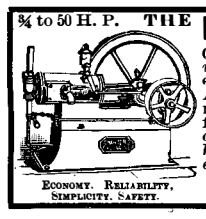

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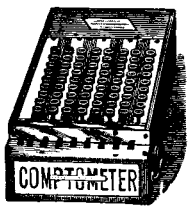



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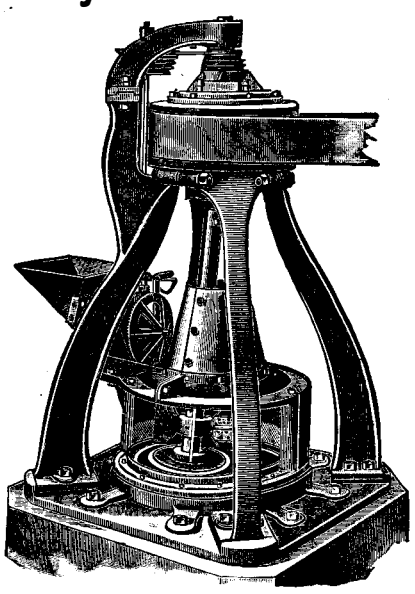

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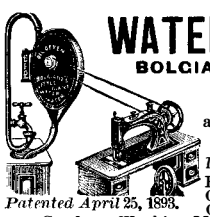

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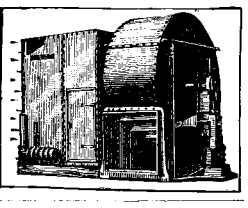

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